

SEQUENCE LISTING

5 <110> Alex Bollen
 Alain Fauconnier
 Edmond Godfroid
 <120> Vaccine
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 Ala Thr Ser Arg Asn Asp Ile Val Leu Ala Val Leu Ile Val Ala Ile
 20 25 30
 35 gtc ttc atg atg atc ctg ccg ttg ccc aca acg ctg gtc gac gtg ctg 144
 Val Phe Met Met Ile Leu Pro Leu Pro Thr Thr Leu Val Asp Val Leu
 35 40 45
 40 atc ggt gcg aac atg acg ctg tcg gca gtc ctg ctg atg gtc gcg atg 192
 Ile Gly Ala Asn Met Thr Leu Ser Ala Val Leu Leu Met Val Ala Met
 50 55 60
 45 tac ctg cct tcg ccc ctg gcg ttt tcc tcg ttc cct tcg gtc ctg ctg 240
 Tyr Leu Pro Ser Pro Leu Ala Phe Ser Ser Phe Pro Ser Val Leu Leu
 65 70 75 80
 50 gtc acc acg ctg ttc cgg ctg ggc atc tcc atc gcg acc acg cgg ctg 288
 Val Thr Thr Leu Phe Arg Leu Gly Ile Ser Ile Ala Thr Thr Arg Leu
 85 90 95
 55 atc ctg ctg caa ggc gat gcc ggc cac atc atc gag acc ttc ggc aac 336
 Ile Leu Leu Gln Gly Asp Ala Gly His Ile Ile Glu Thr Phe Gly Asn
 100 105 110
 60 ttc gtg gtg ggc ggc aac ctg atc gtc ggc ctg gtg gtt ttc ctc atc 384
 Phe Val Val Gly Gly Asn Leu Ile Val Gly Leu Val Val Phe Leu Ile
 115 120 125
 ctc acg atc gtg cag ttc gtg gtc atc acc aaa ggc gcg gag cgg gtg 432
 Leu Thr Ile Val Gln Phe Val Val Ile Thr Lys Gly Ala Glu Arg Val
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5	gcc gaa gtc gcc gcg cgc ttc tcg ctg gac gcc atg ccc ggc aag cag Ala Glu Val Ala Ala Arg Phe Ser Leu Asp Ala Met Pro Gly Lys Gln 145 150 155 160	480
10	atg tcc atc gac gcg gac ttg cgc gcg ggc acc ata gac atg gac gaa Met Ser Ile Asp Ala Asp Leu Arg Ala Gly Thr Ile Asp Met Asp Glu 165 170 175	528
15	gcc cga cgc cga cgc cgt acg gtc gag aag gaa agc caa ctg tat ggc Ala Arg Arg Arg Arg Arg Thr Val Glu Lys Glu Ser Gln Leu Tyr Gly 180 185 190	576
20	gcc atg gac ggc gcg atg aag ttc gtc aag ggc gat gcc atc gcc ggc Ala Met Asp Gly Ala Met Lys Phe Val Lys Gly Asp Ala Ile Ala Gly 195 200 205	624
25	ctg atc atc gtt gcc gtc aac ctg ott ggc ggc atg ctg gtc ggc gtg Leu Ile Ile Val Ala Val Asn Leu Leu Gly Gly Met Leu Val Gly Val 210 215 220	672
30	ctg cag cgc ggc ctg agc gcc ggc gag gcc gtg cag aca tat gcc atc Leu Gln Arg Gly Leu Ser Ala Gly Glu Ala Val Gln Thr Tyr Ala Ile 225 230 235 240	720
35	ctg acc ata ggc gac ggg ctc atc gcg cag atc ccg gcg ctg ttc atc Leu Thr Ile Gly Asp Gly Leu Ile Ala Gln Ile Pro Ala Leu Phe Ile 245 250 255	768
40	gcc atc tgc gcc gga atc atc gtg acg cgg gtg cag acc ggg gat ggc Ala Ile Cys Ala Gly Ile Ile Val Thr Arg Val Gln Thr Gly Asp Gly 260 265 270	816
45	ccc tcc aac gta ggc acc gac atc ggc gca caa gtg ctg gcg cag cct Pro Ser Asn Val Gly Thr Asp Ile Gly Ala Gln Val Leu Ala Gln Pro 275 280 285	864
50	cgc gcc ctg gtc att gcc ggc gcg atc tcg gca ggc ctg ggc ctc att Arg Ala Leu Val Ile Ala Gly Ala Ile Ser Ala Gly Leu Gly Leu Ile 290 295 300	912
55	ccc ggc atg ccc acg ctg gtc ttc ttc gcc ctg gcc gcc gcg gtg ggc Pro Gly Met Pro Thr Leu Val Phe Phe Ala Leu Ala Ala Val Gly 305 310 315 320	960
60	acc atc ggt ttc gta ctg ctg cgc gca tcc cag cgt ccg ccc gaa ggc Thr Ile Gly Phe Val Leu Leu Arg Ala Ser Gln Arg Pro Pro Glu Gly 325 330 335	1008
65	gcc gag ccc gcg ctc gcc ggc atg gct gcc gac ggc cag ccc cgc acc Ala Glu Pro Ala Leu Ala Gly Met ala Ala Asp Gly Gln Pro Arg Thr 340 345 350	1056
70	cgc gcg ccg gcg gat ggg cag gcg gaa ttc gcc ccc acc gtc ccg ctg Arg Ala Pro Ala Asp Gly Gln Ala Glu Phe Ala Pro Thr Val Pro Leu 355 360 365	1104
75	atc atc gac gta gcc gcg cgg ctg cag ccc cgg ttc gag ccg gcc acc Ile Ile Asp Val Ala Ala Arg Leu Gln Pro Arg Phe Glu Pro Ala Thr 370 375 380	1152

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	ggc gtg ccg ttt ccc ggc atc cag ttg cgc ttc acc gaa gcg ctg gcc Gly Val Pro Phe Pro Gly Ile Gln Leu Arg Phe Thr Glu Ala Leu Ala 405 410 415	1248
10	gcc aat acc tac acc atc gtg ctg tcg gag atc ccg gtg gcg caa gga Ala Asn Thr Tyr Thr Ile Val Leu Ser Glu Ile Pro Val Ala Gln Gly 420 425 430	1296
15	atg ttg cgc gac gat gcc gtg ctg gtg cgg gac acc gag cag aac ctg Met Leu Arg Asp Asp Ala Val Leu Val Arg Asp Thr Glu Gln Asn Leu 435 440 445	1344
20	cag gcc ctg cgg atc gca tac gaa acg ggc gcg gcc ttt ctg ccc gat Gln Ala Leu Arg Ile Ala Tyr Glu Thr Gly Ala Ala Phe Leu Pro Asp 450 455 460	1392
25	acg ccc acg atc tgg gtt gcg gcc agt ctg acc ggc gcc ttg cgc gat Thr Pro Thr Ile Trp Val Ala Ala Ser Leu Thr Gly Ala Leu Arg Asp 465 470 475 480	1440
	gca ggt att cct tac ctg ggt atc agc cag atc ctg act tgg cac ttg Ala Gly Ile Pro Tyr Leu Gly Ile Ser Gln Ile Leu Thr Trp His Leu 485 490 495	1488
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35	acc cgg ttt ctg ctt tcg gcc atg gaa gaa cga ttt ccc gat ctg gtc Thr Arg Phe Leu Leu Ser Ala Met Glu Glu Arg Phe Pro Asp Leu Val 515 520 525	1584
40	aag gag tgc ctg cgc gtc atg ccg gtg cag aag att gcc gaa atc ctg Lys Glu Cys Leu Arg Val Met Pro Val Gln Lys Ile Ala Glu Ile Leu 530 535 540	1632
45	cag cgc ctt gtt tcc gaa gaa gtg tcg ata cgc aac ctg cgc gcc gtc Gln Arg Leu Val Ser Glu Glu Val Ser Ile Arg Asn Leu Arg Ala Val 545 550 555 560	1680
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55	tac acc agc ggc cac aat atc ctg ccc gcc tac ctg ctg gcc ccc aag Tyr Thr Ser Gly His Asn Ile Leu Pro Ala Tyr Leu Leu Ala Pro Lys 595 600 605	1824
60	gtc gag gaa acc gtg cgc gcc gcc atc cgg cag acc gcc gcc ggc agt Val Glu Glu Thr Val Arg Ala Ala Ile Arg Gln Thr Ala Ala Gly Ser 610 615 620	1872

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 Tyr Leu Ala Leu Asp Pro Asp Thr Thr Arg Arg Leu Val Glu His Ile
 625 630 635 640

10 cgt caa tgt gtc ggc gat ctg gcc gcc ggc gcg agc cgt ccc gtc ttg 1968
 Arg Gln Cys Val Gly Asp Leu Ala Ala Gly Ala Ser Arg Pro Val Leu
 645 650 655

15 ctg acg tcg atg gac atc cgg cgc tac acg cgc aag atg ata gaa gcc 2016
 Leu Thr Ser Met Asp Ile Arg Arg Tyr Thr Arg Lys Met Ile Glu Ala
 660 665 670

20 gat ctc tac gcc ctg ccg gtg ctg tcc tac cag gaa ctg acg ccg gag 2064
 Asp Leu Tyr Ala Leu Pro Val Leu Ser Tyr Gln Glu Leu Thr Pro Glu
 675 680 685

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 35 40 45
 Ile Gly Ala Asn Met Thr Leu Ser Ala Val Leu Leu Met Val Ala Met
 50 55 60
 Tyr Leu Pro Ser Pro Leu Ala Phe Ser Ser Phe Pro Ser Val Leu Leu
 65 70 75 80
 Val Thr Thr Leu Phe Arg Leu Gly Ile Ser Ile Ala Thr Thr Arg Leu
 85 90 95
 Ile Leu Leu Gln Gly Asp Ala Gly His Ile Ile Glu Thr Phe Gly Asn
 100 105 110
 Phe Val Val Gly Gly Asn Leu Ile Val Gly Leu Val Val Phe Leu Ile
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 Leu Thr Ile Val Gln Phe Val Val Ile Thr Lys Gly Ala Glu Arg Val
 130 135 140
 Ala Glu Val Ala Ala Arg Phe Ser Leu Asp Ala Met Pro Gly Lys Gln
 145 150 155 160
 Met Ser Ile Asp Ala Asp Leu Arg Ala Gly Thr Ile Asp Met Asp Glu
 165 170 175
 Ala Arg Arg Arg Arg Thr Val Glu Lys Glu Ser Gln Leu Tyr Gly
 180 185 190
 Ala Met Asp Gly Ala Met Lys Phe Val Lys Gly Asp Ala Ile Ala Gly
 195 200 205
 Leu Ile Ile Val Ala Val Asn Leu Leu Gly Gly Met Leu Val Gly Val
 210 215 220
 Leu Gln Arg Gly Leu Ser Ala Gly Glu Ala Val Gln Thr Tyr Ala Ile
 225 230 235 240
 Leu Thr Ile Gly Asp Gly Leu Ile Ala Gln Ile Pro Ala Leu Phe Ile
 245 250 255

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10	Thr	Ile	Gly	Phe	Val	Leu	Leu	Arg	Ala	Ser	Gln	Arg	Pro	Pro	Glu	Gly
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	Ala	Glu	Pro	Ala	Leu	Ala	Gly	Met	Ala	Ala	Asp	Gly	Gln	Pro	Arg	Thr
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	Ala	Asn	Thr	Tyr	Thr	Ile	Val	Leu	Ser	Glu	Ile	Pro	Val	Ala	Gln	Gly
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25	Gln	Ala	Leu	Arg	Ile	Ala	Tyr	Glu	Thr	Gly	Ala	Ala	Phe	Leu	Pro	Asp
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	Thr	Pro	Thr	Ile	Trp	Val	Ala	Ala	Ser	Leu	Thr	Gly	Ala	Leu	Arg	Asp
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30	Ala	Gly	Ile	Pro	Tyr	Leu	Gly	Ile	Ser	Gln	Ile	Leu	Thr	Trp	His	Leu
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	Ala	Tyr	Val	Leu	Lys	Lys	Tyr	Ser	Ala	Asp	Phe	Ile	Gly	Ile	Gln	Glu
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	Thr	Arg	Phe	Leu	Leu	Ser	Ala	Met	Glu	Glu	Arg	Phe	Pro	Asp	Leu	Val
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35	Lys	Glu	Cys	Leu	Arg	Val	Met	Pro	Val	Gln	Lys	Ile	Ala	Glu	Ile	Leu
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	Gln	Arg	Leu	Val	Ser	Glu	Glu	Val	Ser	Ile	Arg	Asn	Leu	Arg	Ala	Val
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40	Leu	Glu	Ala	Leu	Val	Glu	Trp	Gly	Gln	Lys	Glu	Lys	Asp	Thr	Val	Leu
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Glu Ala Leu Arg His Ile Leu Asp Ala Gly Ala Ser Met Gly Gly Leu
          20          25          30

cag ggg ttg gac gag gcg cag cag cag gcg ttg tac gcg atc ggt cat      144
Gln Gly Leu Asp Glu Ala Gln Gln Ala Leu Tyr Ala Ile Gly His
          35          40          45

ggc gcc tac gaa cag ggg cgc tat gcc gac gcg ttg aaa atg ttc tgc      192
Gly Ala Tyr Glu Gln Gly Arg Tyr Ala Asp Ala Leu Lys Met Phe Cys
          50          55          60

ctg ctg gtc gcg tgc gat ccg ctg gaa gcc cgt tat ctg ctg gcc ctg      240
Leu Leu Val Ala Cys Asp Pro Leu Glu Ala Arg Tyr Leu Leu Ala Leu
  65          70          75          80

ggc gcc gcg gcc cag gag ctg ggg ctg tac gag cat gcc ttg cag caa      288
Gly Ala Ala Ala Gln Glu Leu Gly Leu Tyr Glu His Ala Leu Gln Gln
          85          90          95

tac gcg gcc gcg gcg gct ttg cag ttg gac tcc ccc agg ccc ctg ttg      336
Tyr Ala Ala Ala Ala Ala Leu Gln Leu Asp Ser Pro Arg Pro Leu Leu
          100          105          110

cat ggc gcc gag tgc ctg tat gcg ttg ggt cgt cgc cgc gac gcc ctg      384
His Gly Ala Glu Cys Leu Tyr Ala Leu Gly Arg Arg Arg Asp Ala Leu
          115          120          125

gat acg ctc gac atg gtg ctt gag ttg tgc ggc tcg ccg gag cgt gcg      432
Asp Thr Leu Asp Met Val Leu Glu Leu Cys Gly Ser Pro Glu Arg Ala
          130          135          140

gcc ctg cgc gaa cgg gcc gag ttg ctg cgc agg agc tat gca cgt gcc      480
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Asp *      486

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<213> Bordetella pertussis

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5	Gly	Ala	Tyr	Glu	Gln	Gly	Arg	Tyr	Ala	Asp	Ala	Leu	Lys	Met	Phe	Cys	
			50				55					60					
	Leu	Leu	Val	Ala	Cys	Asp	Pro	Leu	Glu	Ala	Arg	Tyr	Leu	Leu	Ala	Leu	
			65			70					75					80	
10	Gly	Ala	Ala	Ala	Gln	Glu	Leu	Gly	Leu	Tyr	Glu	His	Ala	Leu	Gln	Gln	
				85						90					95		
	Tyr	Ala	Ala	Ala	Ala	Ala	Leu	Gln	Leu	Asp	Ser	Pro	Arg	Pro	Leu	Leu	
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	His	Gly	Ala	Glu	Cys	Leu	Tyr	Ala	Leu	Gly	Arg	Arg	Arg	Asp	Ala	Leu	
			115					120					125				
15	Asp	Thr	Leu	Asp	Met	Val	Leu	Glu	Leu	Cys	Gly	Ser	Pro	Glu	Arg	Ala	
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	Gly	Val	Met	Leu	Leu	Ala	Ala	Gly	Ser	Ala	Trp	Ala	Ala	Pro	Asn	Trp	
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	Val	Leu	Arg	Glu	Phe	Ala	Ala	Gly	Phe	Ser	Leu	Ala	Leu	Gln	Gln	Gly	
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	Lys	Gly	Val	Gln	Gly	Val	Val	Asn	Gly	Arg	Phe	Asn	Ala	Arg	Thr	Pro	
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	Thr	Glu	Phe	Ile	Glu	Arg	Leu	Ser	Gly	Ile	Tyr	Gly	Phe	Asn	Trp	Phe	
55					85					90					95		
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	Val	His	Ala	Gly	Thr	Leu	Tyr	Val	Ser	Arg	Thr	Ser	Asp	Val	Val	Thr	
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	Leu	Leu	Gln	Leu	Gly	Ile	Leu	Asp	Glu	Arg	Phe	Gly	Trp	Gly	Glu	Leu	
			130				135					140					
10	ccg	gcg	caa	ggc	gtg	gcc	atg	gtg	tca	ggg	ccg	ccg	gcc	tat	gtc	gcg	480
	Pro	Ala	Gln	Gly	Val	Ala	Met	Val	Ser	Gly	Pro	Pro	Ala	Tyr	Val	Ala	
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15	ctg	gtc	gag	cag	ggc	gta	gcg	gcg	ttg	ccc	aag	ggg	gcc	ggc	aat	cag	528
	Leu	Val	Glu	Gln	Ala	Val	Ala	Ala	Leu	Pro	Lys	Gly	Ala	Gly	Asn	Gln	
					165					170					175		
	cag	gtg	gcg	gtg	ttt	cgc	ctc	aag	cat	gct	tcc	gtg	agc	gac	cgg	gtg	576
	Gln	Val	Ala	Val	Phe	Arg	Leu	Lys	His	Ala	Ser	Val	Ser	Asp	Arg	Val	
				180					185					190			
20	atc	cgt	tat	cga	gac	cag	cag	gta	gtt	acg	ccg	ggg	atg	gcc	acc	atg	624
	Ile	Arg	Tyr	Arg	Asp	Gln	Gln	Val	Val	Thr	Pro	Gly	Met	ala	Thr	Met	
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25	ctg	cgc	caa	ttg	atc	ctg	ggg	gcg	ggg	ccg	ggc	aac	gac	gcg	gcg	ctg	672
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			210				215					220					
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	Ala	Ala	Val	Ala	Ala	Pro	Leu	Arg	Glu	Asn	Pro	Pro	Val	Phe	Gly	Asp	
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	Ala	Ala	Ala	Asp	Gly	Asn	Ala	Pro	Leu	Ala	Gly	Ala	Ala	Gln	Ala	Ala	
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	Gly	Arg	Arg	Leu	Ser	Glu	Pro	Ser	Val	Gln	Ala	Asp	Thr	Arg	Leu	Asn	
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40	gcc	ttg	atc	gtg	cag	gat	att	ccc	gaa	cgg	atg	cca	atc	tac	cgt	gcc	864
	Ala	Leu	Ile	Val	Gln	Asp	Ile	Pro	Glu	Arg	Met	Pro	Ile	Tyr	Arg	Ala	
			275					280					285				
45	ctg	atc	gag	cag	ttg	gat	gtg	ccc	agc	acc	ctg	atc	gaa	ata	gag	gcc	912
	Leu	Ile	Glu	Gln	Leu	Asp	Val	Pro	Ser	Thr	Leu	Ile	Glu	Ile	Glu	Ala	
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	Met	Ile	Val	Asp	Val	Asn	Thr	Asp	Leu	Val	Asn	Glu	Leu	Gly	Val	Thr	
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55	tgg	ggg	gcg	cag	atc	gga	acc	acc	agc	ctg	ggc	tat	ggc	gat	ctg	ggg	1008
	Trp	Gly	Ala	Gln	Ile	Gly	Thr	Thr	Ser	Leu	Gly	Tyr	Gly	Asp	Leu	Gly	
					325					330					335		
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	Leu	Arg	Pro	Gly	Asn	Gly	Leu	Pro	Val	Asp	Gly	Ala	Ala	Ala	Asp	Leu	
				340					345					350			
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	Ala	Pro	Gly	Thr	Leu	Gly	Ile	Ser	Val	Ser	Thr	Arg	Leu	Ala	Ala	Arg	
			355					360					365				
5	ttg	cgt	gcg	ttg	gag	tcg	gac	ggg	cag	gcc	aat	atc	ctg	tct	cag	ccg	1152
	Leu	Arg	Ala	Leu	Glu	Ser	Asp	Gly	Gln	Ala	Asn	Ile	Leu	Ser	Gln	Pro	
			370				375					380					
10	tcc	atc	ctg	acc	gcc	gac	aac	ctc	ggc	gcc	atg	ata	gac	ctg	tcg	gat	1200
	Ser	Ile	Leu	Thr	Ala	Asp	Asn	Leu	Gly	Ala	Met	Ile	Asp	Leu	Ser	Asp	
						390					395					400	
15	acc	ttc	tac	att	cgc	acc	ctg	ggc	gag	cgc	gta	gcg	aca	gtc	acg	cct	1248
	Thr	Phe	Tyr	Ile	Arg	Thr	Leu	Gly	Glu	Arg	Val	Ala	Thr	Val	Thr	Pro	
					405					410					415		
20	gtc	acg	gtg	ggt	acg	tcg	ttg	cgt	gtg	acg	ccg	cgc	tat	atc	gcc	gcc	1296
	Val	Thr	Val	Gly	Thr	Ser	Leu	Arg	Val	Thr	Pro	Arg	Tyr	Ile	Ala	Ala	
				420					425					430			
25	aag	gga	gga	cgc	cag	gtg	gaa	ttg	gcg	atc	gat	atc	gag	gac	gga	cgg	1344
	Lys	Gly	Gly	Arg	Gln	Val	Glu	Leu	Ala	Ile	Asp	Ile	Glu	Asp	Gly	Arg	
			435				440						445				
30	gtc	ttg	cag	gag	tat	ccc	atc	gat	ggt	ctg	ccc	cgg	gtt	cgg	aaa	agc	1392
	Val	Leu	Gln	Glu	Tyr	Pro	Ile	Asp	Gly	Leu	Pro	Arg	Val	Arg	Lys	Ser	
			450				455					460					
35	agc	atc	agc	acg	ctg	gcg	gtg	gtg	ggg	gac	gag	cag	acg	ctg	ctg	atc	1440
	Ser	Ile	Ser	Thr	Leu	Ala	Val	Val	Gly	Asp	Glu	Gln	Thr	Leu	Leu	Ile	
						470					475					480	
40	ggc	ggc	tac	aac	aat	cgc	cgt	gac	gaa	gag	cag	gtc	gag	aaa	gtg	ccg	1488
	Gly	Gly	Tyr	Asn	Asn	Arg	Arg	Asp	Glu	Glu	Gln	Val	Glu	Lys	Val	Pro	
					485					490					495		
45	ctg	ctg	gga	gat	atc	ccc	ggc	ctg	ggg	ttc	ttg	ttc	tcg	agc	aag	tcc	1536
	Leu	Leu	Gly	Asp	Ile	Pro	Gly	Leu	Gly	Phe	Leu	Phe	Ser	Ser	Lys	Ser	
				500					505					510			
50	cgg	gcg	gta	cag	cgc	cgc	gag	cgg	ctg	ttc	ctg	atc	cgg	ccg	cgt	gtc	1584
	Arg	Ala	Val	Gln	Arg	Arg	Glu	Arg	Leu	Phe	Leu	Ile	Arg	Pro	Arg	Val	
			515				520						525				
55	gtg	gct	atc	gag	ggc	aag	ccg	gtc	ttc	agc	ccc	gtt	gcg	ggc	acg	tcg	1632
	Val	Ala	Ile	Glu	Gly	Lys	Pro	Val	Phe	Ser	Pro	Val	Ala	Gly	Thr	Ser	
			530				535					540					
60	cag	gtg	ttc	atg	agc	acg	ggt	tgg	ggc	ggg	cat	ggc	agc	agc	ctg	agc	1680
	Gln	Val	Phe	Met	Ser	Thr	Gly	Trp	Gly	Gly	His	Gly	Ser	Ser	Leu	Ser	
						550					555					560	
65	att	gca	ccc	ggc	gag	ggc	ggg	cat	aca	caa	gtg	cgt	cat	gat	gcc	cgg	1728
	Ile	Ala	Pro	Gly	Glu	Gly	Gly	His	Thr	Gln	Val	Arg	His	Asp	Ala	Arg	
					565					570					575		
70	gcg	ggc	agg	ccg	gtc	cgg	ctg	gtg	ccg	gat	tca	ttg	cat	gtg	gag	tat	1776
	Ala	Gly	Arg	Pro	Val	Arg	Leu	Val	Pro	Asp	Ser	Leu	His	Val	Glu	Tyr	
				580					585					590			
75	ggc	gag	gcg	ggg	gag	gcg	tcg	ccc	tga								1803

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Gly Glu Ala Gly Glu Ala Ser Pro *
 595 600

5 <210> 6
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 <212> PRT
 <213> Bordetella pertussis

10 <400> 6
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 Gly Val Met Leu Leu Ala Ala Gly Ser Ala Trp Ala Ala Pro Asn Trp
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 15 Pro Leu Ala Pro Tyr Ser Tyr Tyr Ala Gln Gln Gln Ser Leu Ser Asp
 35 40 45
 Val Leu Arg Glu Phe Ala Ala Gly Phe Ser Leu Ala Leu Gln Gln Gly
 50 55 60
 20 Lys Gly Val Gln Gly Val Val Asn Gly Arg Phe Asn Ala Arg Thr Pro
 65 70 75 80
 Thr Glu Phe Ile Glu Arg Leu Ser Gly Ile Tyr Gly Phe Asn Trp Phe
 85 90 95
 Val His Ala Gly Thr Leu Tyr Val Ser Arg Thr Ser Asp Val Val Thr
 100 105 110
 25 Arg Ala Val Asp Ala Ala Gly Ala Ser Pro Ser Ala Leu Arg Gln Ala
 115 120 125
 Leu Leu Gln Leu Gly Ile Leu Asp Glu Arg Phe Gly Trp Gly Glu Leu
 130 135 140
 30 Pro Ala Gln Gly Val Ala Met Val Ser Gly Pro Ala Tyr Val Ala
 145 150 155 160
 Leu Val Glu Gln Ala Val Ala Ala Leu Pro Lys Gly Ala Gly Asn Gln
 165 170 175
 Gln Val Ala Val Phe Arg Leu Lys His Ala Ser Val Ser Asp Arg Val
 180 185 190
 35 Ile Arg Tyr Arg Asp Gln Gln Val Thr Pro Gly Met ala Thr Met
 195 200 205
 Leu Arg Gln Leu Ile Leu Gly Ala Gly Pro Gly Asn Asp Ala Ala Leu
 210 215 220
 40 Ala Ala Val Ala Ala Pro Leu Arg Glu Asn Pro Pro Val Phe Gly Asp
 225 230 235 240
 Ala Ala Ala Asp Gly Asn Ala Pro Leu Ala Gly Ala Ala Gln Ala Ala
 245 250 255
 Gly Arg Arg Leu Ser Glu Pro Ser Val Gln Ala Asp Thr Arg Leu Asn
 260 265 270
 45 Ala Leu Ile Val Gln Asp Ile Pro Glu Arg Met Pro Ile Tyr Arg Ala
 275 280 285
 Leu Ile Glu Gln Leu Asp Val Pro Ser Thr Leu Ile Glu Ile Glu Ala
 290 295 300
 50 Met Ile Val Asp Val Asn Thr Asp Leu Val Asn Glu Leu Gly Val Thr
 305 310 315 320
 Trp Gly Ala Gln Ile Gly Thr Thr Ser Leu Gly Tyr Gly Asp Leu Gly
 325 330 335
 Leu Arg Pro Gly Asn Gly Leu Pro Val Asp Gly Ala Ala Ala Asp Leu
 340 345 350
 55 Ala Pro Gly Thr Leu Gly Ile Ser Val Ser Thr Arg Leu Ala Ala Arg
 355 360 365
 Leu Arg Ala Leu Glu Ser Asp Gly Gln Ala Asn Ile Leu Ser Gln Pro
 370 375 380
 60 Ser Ile Leu Thr Ala Asp Asn Leu Gly Ala Met Ile Asp Leu Ser Asp
 385 390 395 400

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	Thr	Phe	Tyr	Ile	Arg	Thr	Leu	Gly	Glu	Arg	Val	Ala	Thr	Val	Thr	Pro	
				405						410					415		
	Val	Thr	Val	Gly	Thr	Ser	Leu	Arg	Val	Thr	Pro	Arg	Tyr	Ile	Ala	Ala	
				420					425					430			
5	Lys	Gly	Gly	Arg	Gln	Val	Glu	Leu	Ala	Ile	Asp	Ile	Glu	Asp	Gly	Arg	
				435				440					445				
	Val	Leu	Gln	Glu	Tyr	Pro	Ile	Asp	Gly	Leu	Pro	Arg	Val	Arg	Lys	Ser	
				450			455					460					
10	Ser	Ile	Ser	Thr	Leu	Ala	Val	Val	Gly	Asp	Glu	Gln	Thr	Leu	Leu	Ile	
	465				470						475					480	
	Gly	Gly	Tyr	Asn	Asn	Arg	Arg	Asp	Glu	Glu	Gln	Val	Glu	Lys	Val	Pro	
				485					490						495		
	Leu	Leu	Gly	Asp	Ile	Pro	Gly	Leu	Gly	Phe	Leu	Phe	Ser	Ser	Lys	Ser	
				500					505					510			
15	Arg	Ala	Val	Gln	Arg	Arg	Glu	Arg	Leu	Phe	Leu	Ile	Arg	Pro	Arg	Val	
				515				520					525				
	Val	Ala	Ile	Glu	Gly	Lys	Pro	Val	Phe	Ser	Pro	Val	Ala	Gly	Thr	Ser	
		530					535					540					
20	Gln	Val	Phe	Met	Ser	Thr	Gly	Trp	Gly	Gly	His	Gly	Ser	Ser	Leu	Ser	
	545					550					555					560	
	Ile	Ala	Pro	Gly	Glu	Gly	Gly	His	Thr	Gln	Val	Arg	His	Asp	Ala	Arg	
				565					570						575		
	Ala	Gly	Arg	Pro	Val	Arg	Leu	Val	Pro	Asp	Ser	Leu	His	Val	Glu	Tyr	
				580					585					590			
25	Gly	Glu	Ala	Gly	Glu	Ala	Ser	Pro									
			595					600									
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40	Met	Thr	Thr	Ala	Leu	Glu	Phe	Arg	Val	Leu	Ser	Gly	Ala	Gln	Cys	Met	
	1				5					10					15		
	gcg	cgc	tgc	ccg	gcc	gtg	cat	ggc	gcg	cgc	gtg	ggc	gcc	aat	ccg	cat	96
	Ala	Arg	Cys	Pro	Ala	Val	His	Gly	Ala	Arg	Val	Gly	Ala	Asn	Pro	His	
45				20					25					30			
	tgc	gat	atc	gtc	ctg	acc	ggc	gag	gac	atg	ccc	gaa	gtg	gcg	gga	tgg	144
	Cys	Asp	Ile	Val	Leu	Thr	Gly	Glu	Asp	Met	Pro	Glu	Val	Ala	Gly	Trp	
			35					40					45				
50	ctg	gag	atc	gac	cag	tcc	ggc	tgg	cgg	ttg	gcc	ggc	gcc	gtg	acg	ccc	192
	Leu	Glu	Ile	Asp	Gln	Ser	Gly	Trp	Arg	Leu	Ala	Gly	Ala	Val	Thr	Pro	
		50					55					60					
55	ggc	ctg	gac	gcc	cag	gcg	ccg	tgt	ccg	ccc	gcg	gcc	ttc	aac	gaa	ccc	240
	Gly	Leu	Asp	Ala	Gln	Ala	Pro	Cys	Pro	Pro	Ala	Ala	Phe	Asn	Glu	Pro	
	65					70					75					80	
	gta	gag	ctg	gga	gcc	gcc	tgg	atc	acc	gtg	gcc	gcc	cct	tcc	gcg	ccg	288
60	Val	Glu	Leu	Gly	Ala	Ala	Trp	Ile	Thr	Val	Ala	Ala	Pro	Ser	Ala	Pro	
					85						90					95	

5	ttg ccc gcg ccg ccg gag ccg tgc ggc ccg gac ggc agc gac aca gcc	336
	Trp Pro Ala Pro Pro Glu Pro Cys Gly Pro Asp Gly Ser Asp Thr Ala	
	100 105 110	
10	ttg cac gac gtc cct ggc tcg aca agc ccg ccg tcc gtc gct gcc ctc	384
	Leu His Asp Val Pro Gly Ser Thr Ser Pro Pro Ser Val Ala Ala Leu	
	115 120 125	
15	atg ccg cgc cga cgt gca gga ccg ccc tgg ctg gcg ctg ggc gcg gcc	432
	Met Pro Arg Arg Arg Ala Gly Arg Pro Trp Leu Ala Leu Gly Ala Ala	
	130 135 140	
20	gcg gcc gtc ctg ctg gtc ggc ctg gcc acg gcg ctg gtt tcc gtg acc	480
	Ala Ala Val Leu Leu Val Gly Leu Ala Thr Ala Leu Val Ser Val Thr	
	145 150 155 160	
25	aca ccc gcc acg ccg ccg gcc gcg ccg ccc cca acg ccc acc gcg ccg	528
	Thr Pro Ala Thr Pro Pro Ala Ala Pro Pro Pro Thr Pro Thr Ala Pro	
	165 170 175	
30	ctg gtc cgc gcc gcg gcg ctc atc gac agc ctg ggc ctt acc gag caa	576
	Leu Val Arg Ala Ala Ala Leu Ile Asp Ser Leu Gly Leu Thr Glu Gln	
	180 185 190	
35	tta caa gcg gcc tac ggc cgt ggc ggc gtg ctc acc gtg acc gga tgg	624
	Leu Gln Ala Ala Tyr Gly Arg Gly Gly Val Leu Thr Val Thr Gly Trp	
	195 200 205	
40	gtg cac gac gag acg gaa ttc gct ccg gtc gcc agg gcg ttg gcg caa	672
	Val His Asp Glu Thr Glu Phe Ala Arg Val Ala Arg Ala Leu Ala Gln	
	210 215 220	
45	ctt gcg cca ccg cct gcc atg cag gta agc agg cag gac gag gcc agg	720
	Leu Ala Pro Arg Pro Ala Met Gln Val Ser Arg Gln Asp Glu Ala Arg	
	225 230 235 240	
50	gcc ctg gcc tgc gat gtc ctg gcg aca ttc ggg gtg cgc tac atg gcg	768
	Ala Leu Ala Cys Asp Val Leu Ala Thr Phe Gly Val Arg Tyr Met ala	
	245 250 255	
55	cgc ccg tac ggc aat ggc cgc ctg gcg atc tcg ggc atc gcc agc gat	816
	Arg Pro Tyr Gly Asn Gly Arg Leu Ala Ile Ser Gly Ile Ala Ser Asp	
	260 265 270	
60	gcg cac gaa cgc gcc gcg gcg ctg cat gcg gtg cgc atg cgc ctg ccg	864
	Ala His Glu Arg Ala Ala Ala Leu His Ala Val Arg Met Arg Leu Pro	
	275 280 285	
65	ggc atg acg atc ctc ggt cgc gat gta cgc ctg gcc gac gag gtc tcg	912
	Gly Met Thr Ile Leu Gly Arg Asp Val Arg Leu Ala Asp Glu Val Ser	
	290 295 300	
70	gcc cag ttc gcg gcc cag ctg gcc gac gaa cgc ctc gac ggc gtc aag	960
	Ala Gln Phe Ala Ala Gln Leu Ala Asp Glu Arg Leu Asp Gly Val Lys	
	305 310 315 320	
75	ctc agc tgg cac gcc gac cgc ctg gac gca gat ccc ggc gga ttg gcg	1008
	Leu Ser Trp His Ala Asp Arg Leu Asp Ala Asp Pro Gly Gly Leu Ala	
	325 330 335	

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5 gca ggc cgc atg gcg cgc ctg cgc gag ctg gtg gcc gcg ttc aac cag 1056
 Ala Gly Arg Met ala Arg Leu Arg Glu Leu Val Ala Ala Phe Asn Gln
 340 345 350

cgc aac tac gac gtc gtc cgg ctg ccg gcc acc gcc gcg cgc gcg acg 1104
 Arg Asn Tyr Asp Val Val Arg Leu Pro Ala Thr Ala Ala Arg Ala Thr
 355 360 365

10 cgg gat cac gtg ccg ttc gag ata cgc agt gtc gtg agc ggc ccg caa 1152
 Arg Asp His Val Pro Phe Glu Ile Arg Ser Val Val Ser Gly Pro Gln
 370 375 380

15 ccg tac ctg atg ctg gcc gat ggc agc cgc ctc ctg gtg ggc gga ctg 1200
 Pro Tyr Leu Met Leu Ala Asp Gly Ser Arg Leu Leu Val Gly Gly Leu
 385 390 395 400

20 cgg gac cag tat cgc ctt acc gcc atc gaa tcc ggc cgc ctg gtc ttc 1248
 Arg Asp Gln Tyr Arg Leu Thr Ala Ile gaa tcc ggc cgc ctg gtc ttc
 405 410 415

25 gat ggt ccc gaa ccg gtc atc gtg acg cga tga 1281
 Asp Gly Pro Glu Pro Val Ile Val Thr Arg *
 420 425

30 <210> 8
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 <213> Bordetella pertussis

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 35 Ala Arg Cys Pro Ala Val His Gly Ala Arg Val Gly Ala Asn Pro His
 20 25 30
 Cys Asp Ile Val Leu Thr Gly Glu Asp Met Pro Glu Val Ala Gly Trp
 35 40 45
 40 Leu Glu Ile Asp Gln Ser Gly Trp Arg Leu Ala Gly Ala Val Thr Pro
 50 55 60
 Gly Leu Asp Ala Gln Ala Pro Cys Pro Pro Ala Phe Asn Glu Pro
 65 70 75 80
 Val Glu Leu Gly Ala Ala Trp Ile Thr Val Ala Ala Pro Ser Ala Pro
 85 90 95
 45 Trp Pro Ala Pro Pro Glu Pro Cys Gly Pro Asp Gly Ser Asp Thr Ala
 100 105 110
 Leu His Asp Val Pro Gly Ser Thr Ser Pro Pro Ser Val Ala Ala Leu
 115 120 125
 50 Met Pro Arg Arg Arg Ala Gly Arg Pro Trp Leu Ala Leu Gly Ala Ala
 130 135 140
 Ala Ala Val Leu Leu Val Gly Leu Ala Thr Ala Leu Val Ser Val Thr
 145 150 155 160
 Thr Pro Ala Thr Pro Pro Ala Ala Pro Pro Thr Pro Thr Ala Pro
 165 170 175
 55 Leu Val Arg Ala Ala Ala Leu Ile Asp Ser Leu Gly Leu Thr Glu Gln
 180 185 190
 Leu Gln Ala Ala Tyr Gly Arg Gly Gly Val Leu Thr Val Thr Gly Trp
 195 200 205
 60 Val His Asp Glu Thr Glu Phe Ala Arg Val Ala Arg Ala Leu Ala Gln
 210 215 220

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Leu Ala Pro Arg Pro Ala Met Gln Val Ser Arg Gln Asp Glu Ala Arg
 225 230 235 240
 Ala Leu Ala Cys Asp Val Leu Ala Thr Phe Gly Val Arg Tyr Met ala
 245 250 255
 5 Arg Pro Tyr Gly Asn Gly Arg Leu Ala Ile Ser Gly Ile Ala Ser Asp
 260 265 270
 Ala His Glu Arg Ala Ala Ala Leu His Ala Val Arg Met Arg Leu Pro
 275 280 285
 10 Gly Met Thr Ile Leu Gly Arg Asp Val Arg Leu Ala Asp Glu Val Ser
 290 295 300
 Ala Gln Phe Ala Ala Gln Leu Ala Asp Glu Arg Leu Asp Gly Val Lys
 305 310 315 320
 Leu Ser Trp His Ala Asp Arg Leu Asp Ala Asp Pro Gly Gly Leu Ala
 325 330 335
 15 Ala Gly Arg Met ala Arg Leu Arg Glu Leu Val Ala Ala Phe Asn Gln
 340 345 350
 Arg Asn Tyr Asp Val Val Arg Leu Pro Ala Thr Ala Ala Arg Ala Thr
 355 360 365
 20 Arg Asp His Val Pro Phe Glu Ile Arg Ser Val Val Ser Gly Pro Gln
 370 375 380
 Pro Tyr Leu Met Leu Ala Asp Gly Ser Arg Leu Leu Val Gly Gly Leu
 385 390 395 400
 Arg Asp Gln Tyr Arg Leu Thr Ala Ile Glu Ser Gly Arg Leu Val Phe
 405 410 415
 25 Asp Gly Pro Glu Pro Val Ile Val Thr Arg
 420 425

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 <213> Bordetella pertussis

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 Met Ser Thr Ser Val Leu Ala Leu Thr Glu Leu Glu Val Arg Leu Ala
 1 5 10 15
 40 tcg ccg ggc ggt tcc gcc ttg cgc gac acc ttg ctg tcg cag ctt ggc 96
 Ser Pro Gly Gly Ser Ala Leu Arg Asp Thr Leu Leu Ser Gln Leu Gly
 20 25 30
 45 gaa ctg gag aca cgt ttg cgc gtc cgc ctg cac gat ggc gtg ggg cgc 144
 Glu Leu Glu Thr Arg Leu Arg Val Arg Leu His Asp Gly Val Gly Arg
 35 40 45
 50 gac acc tat ccc gta tgg cgc gac gcg ctg gcg gcc gcc acc gcg gcc 192
 Asp Thr Tyr Pro Val Trp Arg Asp Ala Leu Ala Ala Ala Thr Ala Ala
 50 55 60
 55 cgg cag gta ttg ctg cag cgc ccg acc ggg ccg gac aac cct ccg gcg 240
 Arg Gln Val Leu Leu Gln Arg Pro Thr Gly Pro Asp Asn Pro Pro Ala
 65 70 75 80
 60 tca gtc ttg acg cgc ctg agc aat gaa caa tgc gcc gaa gga gac aag 288
 Ser Val Leu Thr Arg Leu Ser Asn Glu Gln Cys Ala Glu Gly Asp Lys
 85 90 95

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cat ggc cat taa
His Gly His *

300

5

<210> 10

<211> 99

<212> PRT

10

<213> Bordetella pertussis

<400> 10

Met Ser Thr Ser Val Leu Ala Leu Thr Glu Leu Glu Val Arg Leu Ala
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15 Ser Pro Gly Gly Ser Ala Leu Arg Asp Thr Leu Leu Ser Gln Leu Gly
20 25 30
Glu Leu Glu Thr Arg Leu Arg Val Arg Leu His Asp Gly Val Gly Arg
35 40 45
20 Asp Thr Tyr Pro Val Trp Arg Asp Ala Leu Ala Ala Ala Thr Ala Ala
50 55 60
Arg Gln Val Leu Leu Gln Arg Pro Thr Gly Pro Asp Asn Pro Pro Ala
65 70 75 80
Ser Val Leu Thr Arg Leu Ser Asn Glu Gln Cys Ala Glu Gly Asp Lys
85 90 95
25 His Gly His

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<211> 267

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<212> DNA

<213> Bordetella pertussis

<220>

<221> CDS

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<222> (1)...(267)

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Met ala ile Asn Leu Gly Gly Asp Ala Gly Arg Val Thr Met Gln Ser
1 5 10 15 48
gtc aac cag gcg gtc aat acg cgg ctg aac gct cac gaa cgc gac ctg
Val Asn Gln Ala Val Asn Thr Arg Leu Asn Ala His Glu Arg Asp Leu
20 25 30 96
45 cgc agc cgc ctg gag gcg ctc agc gcg cgc gga gac ggc gcg gtc agc
Arg Ser Arg Leu Glu Ala Leu Ser Ala Arg Gly Asp Gly Ala Val Ser
35 40 45 144
50 acg tcc gac ctg ctg atc gtg caa cag gaa atg caa tcg tgg gtc gtg
Thr Ser Asp Leu Leu Ile Val Gln Gln Glu Met Gln Ser Trp Val Val
50 55 60 192
55 atg atc gat cta cag agc acg gtg gtc aag cag gtc gcg gat tcg ctc
Met ile Asp Leu Gln Ser Thr Val Val Lys Gln Val Ala Asp Ser Leu
65 70 75 80 240
aag ggc gtc ata cag aag gcg agt tga
Lys Gly Val ile Gln Lys Ala Ser *
85 267
60

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5 <210> 12
 <211> 88
 <212> PRT
 <213> Bordetella pertussis

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 Val Asn Gln Ala Val Asn Thr Arg Leu Asn Ala His Glu Arg Asp Leu
 20 25 30
 Arg Ser Arg Leu Glu Ala Leu Ser Ala Arg Gly Asp Gly Ala Val Ser
 35 40 45
 15 Thr Ser Asp Leu Leu Ile Val Gln Gln Glu Met Gln Ser Trp Val Val
 50 55 60
 Met Ile Asp Leu Gln Ser Thr Val Val Lys Gln Val Ala Asp Ser Leu
 65 70 75 80
 20 Lys Gly Val Ile Gln Lys Ala Ser
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 <210> 13
 <211> 327
 <212> DNA
 25 <213> Bordetella pertussis

 <220>
 <221> CDS
 <222> (1)...(327)
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 <400> 13
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 Met ala Asp Gln Ala Arg Phe Glu Leu Ala Leu Gly Glu Met Pro Gly
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 35 gca tcg gcc ccg aac ggg gcg atc gcc ctg gcg ccg gtc gcg ctc gac 96
 Ala Ser Ala Pro Asn Gly Ala Ile Ala Leu Ala Pro Val Ala Leu Asp
 20 25 30
 40 gag ccg ctg ggc cgt cgc att ctt gga cag ttg cgc ggc ggc ctg gcc 144
 Glu Pro Leu Gly Arg Arg Ile Leu Gly Gln Leu Arg Gly Gly Leu Ala
 35 40 45
 45 gat gtg gca gga aaa tgg cgg gcg gtg cag acg ggc ttg gcc gag gtg 192
 Asp Val Ala Gly Lys Trp Arg Ala Val Gln Thr Gly Leu Ala Glu Val
 50 55 60
 50 agc cag gcg cct acc gtg gtg ggt atg ctc gat ctg cag gcc agg ttg 240
 Ser Gln Ala Pro Thr Val Val Gly Met Leu Asp Leu Gln Ala Arg Leu
 65 70 75 80
 55 cta cag gca tcc gtg gag tac gag ttg gtg ggc aag gca ata ggg cgc 288
 Leu Gln Ala Ser Val Glu Tyr Glu Leu Val Gly Lys Ala Ile Gly Arg
 85 90 95
 60 gcc acc caa aac gtc gat acg ctg gcg aga atg tca tga 327
 Ala Thr Gln Asn Val Asp Thr Leu Ala Arg Met Ser *
 100 105

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<210> 14
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 <212> PRT
 <213> Bordetella pertussis

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 20 25 30
 Glu Pro Leu Gly Arg Arg Ile Leu Gly Gln Leu Arg Gly Gly Leu Ala
 35 40 45
 Asp Val Ala Gly Lys Trp Arg Ala Val Gln Thr Gly Leu Ala Glu Val
 50 55 60
 15 Ser Gln Ala Pro Thr Val Val Gly Met Leu Asp Leu Gln Ala Arg Leu
 65 70 75 80
 Leu Gln Ala Ser Val Glu Tyr Glu Leu Val Gly Lys Ala Ile Gly Arg
 85 90 95
 20 Ala Thr Gln Asn Val Asp Thr Leu Ala Arg Met Ser
 100 105

<210> 15
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 <212> DNA
 <213> Bordetella pertussis

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<220>
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 <222> (1)...(825)

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 Met Asn Ala Ile Gly Ala Ile Gln Arg Tyr Arg Arg Gly Ala Gly Trp
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 35 gcg gcc ctg gtg ctc gcc ctg gcg ctg ctg gcc ggc tgc ggt gcc cgc 96
 Ala Ala Leu Val Leu Ala Leu Ala Leu Leu Ala Gly Cys Gly Ala Arg
 20 25 30
 40 gtc gag ctg ttg ggc gcg gcg ccc gag aac gaa gcc aac gaa gta ttg 144
 Val Glu Leu Leu Gly Ala Ala Pro Glu Asn Glu Ala Asn Glu Val Leu
 35 40 45
 45 gcg gcg ctg ctc gag gca ggc atc gct gcg cag aag cag tcc ggc aag 192
 Ala Ala Leu Leu Glu Ala Gly Ile Ala Ala Gln Lys Gln Ser Gly Lys
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 50 gcc ggc tac gcg gtt tcg gtg ccg gcc gag gcg gtg gcc cgg tcg ctg 240
 Ala Gly Tyr Ala Val Ser Val Pro Ala Glu Ala Val Ala Arg Ser Leu
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 55 gag atc ctg cgc gca agc ggc ctg ccc cgc gag cag ttc gac gga atg 288
 Glu Ile Leu Arg Ala Ser Gly Leu Pro Arg Glu Gln Phe Asp Gly Met
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 60 gga cgc ata ttc cgc aag gaa ggc ctg gtt tca tct ccg ctc gaa gag 336
 Gly Arg Ile Phe Arg Lys Glu Gly Leu Val Ser Ser Pro Leu Glu Glu
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 60 cgc gcc cgc tac att tat gcg ctg tct cag gaa ttg gcc gac acc ctg 384

18

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5	gcg ctg ctg tgc gcg ccg cgc ctg cga cgc gcg ata gac ggc gcc gag	336
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10	gtc cgt acc ttg cat gcc gcg ctc ggg cgc gat gtg atg aat ttc gcc	384
	Val Arg Thr Leu His Ala Ala Leu Gly Arg Asp Val Met Asn Phe Ala	
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	Val Ser Ser Ala Ala Arg Ala Leu His Asp Gly Leu Ala Ala Ser Ser	
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	Asp Trp Thr Leu Ala Ala Thr Val Gln Ala Ala Gln Lys Leu Gly Trp	
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	Ala Leu Leu Arg Asp Ala Val Gln Gly Ala Ala Asp Glu Ile Ala Leu	
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	Arg Cys Ala Leu Lys Leu Pro Arg Asp Leu Asp Pro Ala Pro Val Leu	
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	Pro Pro Glu Ala Ala Leu Ala Leu Val Leu Ser Met Leu Glu Ile Leu	
	195 200 205	
40	gat gca gaa tgg ctt tcc tgc ttc ccc gcc caa gcc tga	663
	Asp Ala Glu Trp Leu Ser Ser Phe Pro Ala Gln Ala *	
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	Asn Ala Trp His Arg His Trp Ser Arg Trp Ile Leu Cys Glu Leu Gly	
	50 55 60	
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55	Ala Leu Leu Cys Ala Pro Arg Leu Arg Arg Ala Ile Asp Gly Ala Glu	
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	Val Arg Thr Leu His Ala Ala Leu Gly Arg Asp Val Met Asn Phe Ala	
	115 120 125	
60	Val Ser Ser Ala Ala Arg Ala Leu His Asp Gly Leu Ala Ala Ser Ser	
	130 135 140	
	Asp Trp Thr Leu Ala Ala Thr Val Gln Ala Ala Gln Lys Leu Gly Trp	
	145 150 155 160	

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Ala Leu Leu Arg Asp Ala Val Gln Gly Ala Ala Asp Glu Ile Ala Leu
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 Arg Cys Ala Leu Lys Leu Pro Arg Asp Leu Asp Pro Ala Pro Val Leu
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 Glu Leu Leu Ser Ala Ala Gln Ile Val Ala Gln Ala His Arg Arg Ala
 35 40 45

35 ggc gaa atc gtg gcc gag gcg cga gag gag ttc gag cgc gag cgc agg 192
 Gly Glu Ile Val Ala Glu Ala Arg Glu Glu Phe Glu Arg Glu Arg Arg
 50 55 60

40 cga ggc tat gag gag ggg cgc cgc gaa gcg ctt acg gat cag gcg gag 240
 Arg Gly Tyr Glu Glu Gly Arg Arg Glu Ala Leu Thr Asp Gln Ala Glu
 65 70 75 80

40 aag atg ata gaa acc gta agc cgc acg atc gac tac ttc gcg ggt atc 288
 Lys Met Ile Glu Thr Val Ser Arg Thr Ile Asp Tyr Phe Ala Gly Ile
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45 gag aac gag atg atc gaa ctg gtc atg agt gcg gtc cgc aag atc gtc 336
 Glu Asn Glu Met Ile Glu Leu Val Met Ser Ala Val Arg Lys Ile Val
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50 gac ggt tac gac gac cgc gag cgc acc gtg atc gcc gtg cgc aac gca 384
 Asp Gly Tyr Asp Asp Arg Glu Arg Thr Val Ile Ala Val Arg Asn Ala
 115 120 125

55 ttg gcg gtc gtg cgc aat cag cgc cag atg acc ttg cgc ctg cac cca 432
 Leu Ala Val Val Arg Asn Gln Arg Gln Met Thr Leu Arg Leu His Pro
 130 135 140

60 gac gag gtg gat gtg ctc cgg gaa ggc atg aac cag ctt ctg gcg gcc 480
 Asp Glu Val Asp Val Leu Arg Glu Gly Met Asn Gln Leu Leu Ala Ala
 145 150 155 160

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Tyr Pro Gly Val Gly Tyr Leu Asp Leu Leu Pro Asp Ala Arg Leu Ala
 165 170 175

5 ccg gga gcc tgc ata ctg gag agc gag ata ggc atg gtc gag gcc agc 576
 Pro Gly Ala Cys Ile Leu Glu Ser Glu Ile Gly Met Val Glu Ala Ser
 180 185 190

10 ctc gag gac cag ctg tgc gcc ttg cgg gcg gcc ttc gaa cgt aca ttc 624
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ggc cgg cgc gga tag
 Gly Arg Arg Gly * 639
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 35 40 45
 Gly Glu Ile Val Ala Glu Ala Arg Glu Glu Phe Glu Arg Glu Arg Arg
 50 55 60
 Arg Gly Tyr Glu Glu Gly Arg Arg Glu Ala Leu Thr Asp Gln Ala Glu
 65 70 75 80
 Lys Met Ile Glu Thr Val Ser Arg Thr Ile Asp Tyr Phe Ala Gly Ile
 85 90 95
 35 Glu Asn Glu Met Ile Glu Leu Val Met Ser Ala Val Arg Lys Ile Val
 100 105 110
 Asp Gly Tyr Asp Asp Arg Glu Arg Thr Val Ile Ala Val Arg Asn Ala
 115 120 125
 40 Leu Ala Val Val Arg Asn Gln Arg Gln Met Thr Leu Arg Leu His Pro
 130 135 140
 Asp Glu Val Asp Val Leu Arg Glu Gly Met Asn Gln Leu Leu Ala Ala
 145 150 155 160
 Tyr Pro Gly Val Gly Tyr Leu Asp Leu Leu Pro Asp Ala Arg Leu Ala
 165 170 175
 45 Pro Gly Ala Cys Ile Leu Glu Ser Glu Ile Gly Met Val Glu Ala Ser
 180 185 190
 Leu Glu Asp Gln Leu Cys Ala Leu Arg Ala Ala Phe Glu Arg Thr Phe
 195 200 205
 50 Gly Arg Arg Gly
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10	gat ctg tcc acg ctg cgg ata aag ggc cgg gtg gtg caa gtg gtg gga Asp Leu Ser Thr Leu Arg Ile Lys Gly Arg Val Val Gln Val Val Gly 20 25 30	96
15	acg atc atc aag gcc gtc gtt ccg atg gtc aag atc ggc gaa gtg tgc Thr Ile Ile Lys Ala Val Val Pro Met Val Lys Ile Gly Glu Val Cys 35 40 45	144
20	ctg ctg cgc aat ccc ggc gag gac ttc gag atg cac ggc gaa gtg gtg Leu Leu Arg Asn Pro Gly Glu Asp Phe Glu Met His Gly Glu Val Val 50 55 60	192
25	ggc ttt gtc cgc gac gcc gcc ttg ctc acg cct atc ggc gac atg tac Gly Phe Val Arg Asp Ala Ala Leu Leu Thr Pro Ile Gly Asp Met Tyr 65 70 75 80	240
30	ggg att tcc tcg gcg acc gag gtg ata ccg acc gga cgc acg cat atg Gly Ile Ser Ser Ala Thr Glu Val Ile Pro Thr Gly Arg Thr His Met 85 90 95	288
35	gtc ccc gtc ggt ccg ggc ttg ctg gga cgc gtg ctg gac ggg ctg gga Val Pro Val Gly Pro Gly Leu Leu Gly Arg Val Leu Asp Gly Leu Gly 100 105 110	336
40	cgt ccg ctg gac gcc gcc gag tca ggg ccg ctg cat gcc cac aag ttc Arg Pro Leu Asp Ala Ala Glu Ser Gly Pro Leu His Ala His Lys Phe 115 120 125	384
45	tat ccg gtc ttc gcc gat gcg cca gac ccg ctg acg cgt cgc atc atc Tyr Pro Val Phe Ala Asp Ala Pro Asp Pro Leu Thr Arg Arg Ile Ile 130 135 140	432
50	cat gct ccg ctg gag ctg ggg gtg cgc gta ctg gac ggt ttg ctt aca His Ala Pro Leu Glu Leu Gly Val Arg Val Leu Asp Gly Leu Leu Thr 145 150 155 160	480
55	tgc ggg gaa ggc cag cgt ctg gga att ttc gca gcc gcc ggc ggc ggc Cys Gly Glu Gly Gln Arg Leu Gly Ile Phe Ala Ala Ala Gly Gly Gly 165 170 175	528
60	aag tcg acc ctg ctg ggc atg ctg gtc aag ggc gcc gcg gtc gac gtg Lys Ser Thr Leu Leu Gly Met Leu Val Lys Gly Ala Ala Val Asp Val 180 185 190	576
65	acg gtg gtg gcg ctg atc ggc gag cgt ggg cgg gaa gtt cgc gag ttc Thr Val Val Ala Leu Ile Gly Glu Arg Gly Arg Glu Val Arg Glu Phe 195 200 205	624
70	ctt gag cac gaa ctc ggt ccg gag ggc aga cgc aag agc gtg atc gtc Leu Glu His Glu Leu Gly Pro Glu Gly Arg Arg Lys Ser Val Ile Val 210 215 220	672
75	tgc gcg acc agc gac aag tcc tcg atg gag cgt gcc aag gcg gcg tac Cys Ala Thr Ser Asp Lys Ser Ser Met Glu Arg Ala Lys Ala Ala Tyr 225 230 235 240	720

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15	atc ggc ttg gcg gca ggc gag ccg ccg acg cgg cgc ggc tat cca ccg Ile Gly Leu Ala Ala Gly Glu Pro Pro Thr Arg Arg Gly Tyr Pro Pro 275 280 285	864
20	tcg gtg ttc gcc acc ttg ccc aaa ctg atg gag cgc gcc ggc atg aac Ser Val Phe Ala Thr Leu Pro Lys Leu Met Glu Arg Ala Gly Met Asn 290 295 300	912
25	cag acg ggt tcg atc acg gcg ctg tat acg gtg ctg gtc gag ggg gac Gln Thr Gly Ser Ile Thr Ala Leu Tyr Thr Val Leu Val Glu Gly Asp 305 310 315 320	960
30	gac atg aac gaa ccg gtg gcc gac gag acg cgt tcg ata ctg gac ggc Asp Met Asn Glu Pro Val Ala Asp Glu Thr Arg Ser Ile Leu Asp Gly 325 330 335	1008
35	cac atc gtg ctc tcg cgc aag ctg gga gcg gcg aat cac tat cct gcc His Ile Val Leu Ser Arg Lys Leu Gly Ala Ala Asn His Tyr Pro Ala 340 345 350	1056
40	gtc gac gtg ctg gcc tcg gcc agc cgg gtc atg aat gcc gtg gtg tcg Val Asp Val Leu Ala Ser Ala Ser Arg Val Met Asn Ala Val Val Ser 355 360 365	1104
45	ccg cgt cac aag tac ctg gcc gga cgt atg cgc gaa ctg atg gcc aag Pro Arg His Lys Tyr Leu Ala Gly Arg Met Arg Glu Leu Met ala Lys 370 375 380	1152
50	tac cag gat gtc gag ctg ttg gtg aaa atc ggc gag tac aag cag ggc Tyr Gln Asp Val Glu Leu Leu Val Lys Ile Gly Glu Tyr Lys Gln Gly 385 390 395 400	1200
55	gcc gat gcg tcg acc gat gag gcg ata cag aag atc gga cag atc aat Ala Asp Ala Ser Thr Asp Glu Ala Ile Gln Lys Ile Gly Gln Ile Asn 405 410 415	1248
60	gcg ttt ctc aga caa cta acc gac gaa cgc gaa gca ttc gag gat acc Ala Phe Leu Arg Gln Leu Thr Asp Glu Arg Glu Ala Phe Glu Asp Thr 420 425 430	1296
65	gta ctg cgc atg gct gaa atc atc gga ccc gaa tcc taa Val Leu Arg Met ala Glu Ile Ile Gly Pro Glu Ser *	1335
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Met Arg Gln Tyr His Tyr Ile Thr Glu Met Met Arg Val Ala Leu Gln
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Asp Leu Ser Thr Leu Arg Ile Lys Gly Arg Val Val Gln Val Val Gly
 20      25      30
5 Thr Ile Ile Lys Ala Val Val Pro Met Val Lys Ile Gly Glu Val Cys
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Leu Leu Arg Asn Pro Gly Glu Asp Phe Glu Met His Gly Glu Val Val
 50      55      60
10 Gly Phe Val Arg Asp Ala Ala Leu Leu Thr Pro Ile Gly Asp Met Tyr
 65      70      75      80
Gly Ile Ser Ser Ala Thr Glu Val Ile Pro Thr Gly Arg Thr His Met
 85      90      95
Val Pro Val Gly Pro Gly Leu Leu Gly Arg Val Leu Asp Gly Leu Gly
100      105      110
15 Arg Pro Leu Asp Ala Ala Glu Ser Gly Pro Leu His Ala His Lys Phe
115      120      125
Tyr Pro Val Phe Ala Asp Ala Pro Asp Pro Leu Thr Arg Arg Ile Ile
130      135      140
20 His Ala Pro Leu Glu Leu Gly Val Arg Val Leu Asp Gly Leu Leu Thr
145      150      155      160
Cys Gly Glu Gly Gln Arg Leu Gly Ile Phe Ala Ala Ala Gly Gly Gly
165      170      175
Lys Ser Thr Leu Leu Gly Met Leu Val Lys Gly Ala Ala Val Asp Val
180      185      190
25 Thr Val Val Ala Leu Ile Gly Glu Arg Gly Arg Glu Val Arg Glu Phe
195      200      205
Leu Glu His Glu Leu Gly Pro Glu Gly Arg Arg Lys Ser Val Ile Val
210      215      220
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225      230      235      240
Val Ala Thr Ala Ile Ala Glu Tyr Phe Arg Asp Gln Gly Gln Arg Val
245      250      255
Leu Phe Leu Met Asp Ser Val Thr Arg Phe Ala Arg Ala Gln Arg Glu
260      265      270
35 Ile Gly Leu Ala Ala Gly Glu Pro Pro Thr Arg Arg Gly Tyr Pro Pro
275      280      285
Ser Val Phe Ala Thr Leu Pro Lys Leu Met Glu Arg Ala Gly Met Asn
290      295      300
40 Gln Thr Gly Ser Ile Thr Ala Leu Tyr Thr Val Leu Val Glu Gly Asp
305      310      315      320
Asp Met Asn Glu Pro Val Ala Asp Glu Thr Arg Ser Ile Leu Asp Gly
325      330      335
His Ile Val Leu Ser Arg Lys Leu Gly Ala Ala Asn His Tyr Pro Ala
340      345      350
45 Val Asp Val Leu Ala Ser Ala Ser Arg Val Met Asn Ala Val Val Ser
355      360      365
Pro Arg His Lys Tyr Leu Ala Gly Arg Met Arg Glu Leu Met ala Lys
370      375      380
50 Tyr Gln Asp Val Glu Leu Leu Val Lys Ile Gly Glu Tyr Lys Gln Gly
385      390      395      400
Ala Asp Ala Ser Thr Asp Glu Ala Ile Gln Lys Ile Gly Gln Ile Asn
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Ala Phe Leu Arg Gln Leu Thr Asp Glu Arg Glu Ala Phe Glu Asp Thr
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 Ala Gln Leu Ala Leu Lys Arg Gln Gln Gln Ala Cys Ala Val Ala Ala
 20 25 30
 gcg gcg cag cgt cag gcg caa ggc cgc ctc gac gat tgt cgc ctg tgg 144
 Ala Ala Gln Arg Gln Ala Gln Gly Arg Leu Asp Asp Cys Arg Leu Trp
 35 40 45
 gcc gga cag ctc gaa aac cgt cta tat gcc gag ctg tgc cgg cgc atc 192
 Ala Gly Gln Leu Glu Asn Arg Leu Tyr Ala Glu Leu Cys Arg Arg Ile
 50 55 60
 gtc aag aca cgc gac atc gac gag gtg ctg caa cga gtg ggc cac gcc 240
 Val Lys Thr Arg Asp Ile Asp Glu Val Leu Gln Arg Val Gly His Ala
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 Arg Asp Arg Gln Ala Ser Leu Ala Leu Gln Leu Asp Asp Ala Val Arg
 85 90 95
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 Arg His Glu His Glu Ile Gln Leu Leu Ala Gln Gln Arg Glu Gln His
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 Arg Glu Cys Phe Gln Ala Gln Gln Arg Ile Ala Glu Leu Val Arg Leu
 115 120 125
 cag cag gtc gag gcg gcg gcc ttg cgc gag agc cag gaa gat cgc gaa 432
 Gln Gln Val Glu Ala Ala Ala Leu Arg Glu Ser Gln Glu Asp Arg Glu
 130 135 140
 att cag gaa gcc atc gaa ttg tgc gcg cgt ggg cgc gac gat gca tgc 480
 Ile Gln Glu Ala Ile Glu Leu Ser Ala Arg Gly Arg Asp Asp Ala Ser
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 35 40 45
 5 Ala Gly Gln Leu Glu Asn Arg Leu Tyr Ala Glu Leu Cys Arg Arg Ile
 50 55 60
 Val Lys Thr Arg Asp Ile Asp Glu Val Leu Gln Arg Val Gly His Ala
 65 70 75 80
 10 Arg Asp Arg Gln Ala Ser Leu Ala Leu Gln Leu Asp Asp Ala Val Arg
 85 90 95
 Arg His Glu His Glu Ile Gln Leu Leu Ala Gln Gln Arg Glu Gln His
 100 105 110
 Arg Glu Cys Phe Gln Ala Gln Gln Arg Ile Ala Glu Leu Val Arg Leu
 115 120 125
 15 Gln Gln Val Glu Ala Ala Ala Leu Arg Glu Ser Gln Glu Asp Arg Glu
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 Arg Met Gly Val Ala Arg Thr Pro Tyr Ala Arg Gln Pro Asp Arg Asp
 20 25 30
 40 gcg cag cgt gcc ttc gag cgg gaa atg gaa cag gag aaa gcg aag gaa 144
 Ala Gln Arg Ala Phe Glu Arg Glu Met Glu Gln Glu Lys Ala Lys Glu
 35 40 45
 45 gaa ctg ccc ggg ccg caa cgc ctg gcg ccg ggt ccg gcc tgc gtc ggc 192
 Glu Leu Pro Gly Pro Gln Arg Leu Ala Pro Gly Pro Ala Cys Val Gly
 50 55 60
 50 tgg ctg gcg tcg atg gaa cct gcc gcc ggc cgt cca ccg gcc agt ctg 240
 Trp Leu Ala Ser Met Glu Pro Ala Ala Gly Arg Pro Pro Ala Ser Leu
 65 70 75 80
 gcc cag gcg ctg gca agc gtg gct gcg ggg ctg gcg gta ggc gac gtg 288
 Ala Gln Ala Leu Ala Ser Val Ala Ala Gly Leu Ala Val Gly Asp Val
 85 90 95
 55 ctg gag ggg tat cgc gaa gcc cgt atc gtt gtg gac gat acg ctg cta 336
 Leu Glu Gly Tyr Arg Glu Ala Arg Ile Val Val Asp Asp Thr Leu Leu
 100 105 110
 60 ccc gac acc acc ttg tcg gta cgg gag gac ggc ggc tgg atc gtg gtg 384

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Pro Asp Thr Thr Leu Ser Val Arg Glu Asp Gly Gly Trp Ile Val Val
115 120 125

5 gct ttc gca tgc cga caa cgg gac gct tgc gag cgc ctg cac gcg tgc 432
Ala Phe Ala Cys Arg Gln Arg Asp Ala Cys Glu Arg Leu His Ala Cys
130 135 140

10 gcc gac cgg ttg gcc atg gag ctc gcg ctg gag ctg gcg cgc gac gtc 480
Ala Asp Arg Leu Ala Met Glu Leu Ala Leu Glu Leu Ala Arg Asp Val
145 150 155 160

15 gag gtt gcg gtg gca tgc gac ggc gag ccg cac gag cgg gtg gcg cgc 528
Glu Val Ala Val Ala Cys Asp Gly Glu Pro His Glu Arg Val Ala Arg
165 170 175

gcg cag cgg ccg tgg cga tga 549
Ala Gln Arg Pro Trp Arg
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25 <213> Bordetella pertussis

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20 25 30
Ala Gln Arg Ala Phe Glu Arg Glu Met Glu Gln Glu Lys Ala Lys Glu
35 35 40 45
Glu Leu Pro Gly Pro Gln Arg Leu Ala Pro Gly Pro Ala Cys Val Gly
50 55 60
35 Trp Leu Ala Ser Met Glu Pro Ala Ala Gly Arg Pro Pro Ala Ser Leu
65 70 75 80
Ala Gln Ala Leu Ala Ser Val Ala Ala Gly Leu Ala Val Gly Asp Val
85 90 95
40 Leu Glu Gly Tyr Arg Glu Ala Arg Ile Val Val Asp Asp Thr Leu Leu
100 105 110
Pro Asp Thr Thr Leu Ser Val Arg Glu Asp Gly Gly Trp Ile Val Val
115 120 125
Ala Phe Ala Cys Arg Gln Arg Asp Ala Cys Glu Arg Leu His Ala Cys
130 135 140
45 Ala Asp Arg Leu Ala Met Glu Leu Ala Leu Glu Leu Ala Arg Asp Val
145 150 155 160
Glu Val Ala Val Ala Cys Asp Gly Glu Pro His Glu Arg Val Ala Arg
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50 Ala Gln Arg Pro Trp Arg
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	Asp	Leu	Ala	Val	Pro	Arg	Leu	Ser	Ala	Gly	Glu	Ala	His	Ala	Leu	Ser					
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	Arg	Ile	Ala	Cys	His	Gly	Ala	Arg	Phe	Asp	Val	Arg	Leu	Gly	Glu	Pro					
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	Ala	Val	Arg	Trp	His	Cys	Ala	Leu	Thr	Pro	Cys	Val	His	Gly	Asp	Leu					
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	Ala	Asp	Gly	Glu	Met	Glu	Ser	Leu	Gln	Leu	Gln	Trp	Ala	Gly	Thr	Tyr					
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	Ile	Gly	Leu	Thr	Val	Pro	Arg	Ala	Ala	Ala	Ala	Gly	Trp	Leu	Ala	Ala					
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	Arg	Leu	Pro	Arg	Phe	Ser	Gly	Val	Glu	Leu	Pro	Glu	Pro	Ile	Ala	Ala					
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35	gcg	gcc	ctg	gag	gca	atg	ctg	gag	gag	gtc	tgt	cga	ggc	gtg	gcc	gga					384
	Ala	Ala	Leu	Glu	Ala	Met	Leu	Glu	Glu	Val	Cys	Arg	Gly	Val	Ala	Gly					
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40	ctc	gac	cag	caa	ggc	ccg	gtc	cgc	gtg	gcg	cgg	caa	ggc	ggg	acg	cca					432
	Leu	Asp	Gln	Gln	Gly	Pro	Val	Arg	Val	Ala	Arg	Gln	Gly	Gly	Thr	Pro					
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45	ccg	gtc	cag	ccg	cat	cgc	tgg	acc	ctg	acg	gta	cgg	gcg	cct	gac	ggc					480
	Pro	Val	Gln	Pro	His	Arg	Trp	Thr	Leu	Thr	Val	Arg	Ala	Pro	Asp	Gly					
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	Gly	Val	Trp	Arg	Ala	Val	Leu	Ala	Cys	Asp	Ala	Trp	Ala	Leu	Gln	Ala					
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55	gtc	gcg	gcg	gcg	ctg	gat	tcc	gtt	gcg	cct	gcc	gat	ggc	cgg	gtc	aat					576
	Val	Ala	Ala	Ala	Leu	Asp	Ser	Val	Ala	Pro	Ala	Asp	Gly	Arg	Val	Asn					
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60	ccg	gag	cgc	gtg	ccg	gtc	agg	ttg	cgt	gcc	gat	gtc	ggc	gcg	gcg	tcc					624
	Pro	Glu	Arg	Val	Pro	Val	Arg	Leu	Arg	Ala	Asp	Val	Gly	Ala	Ala	Ser					
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	Val	Thr	Ala	Gly	Gln	Leu	Arg	Thr	Leu	Arg	Ala	Gly	Asp	Val	Val	Leu					
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	Leu	Ala	Gln	Tyr	Arg	Val	Ser	Asp	Ala	Ala	Glu	Leu	Trp	Leu	Ser	Ala					
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	Ala	Arg	His	Leu	Trp	Gly	Glu	Glu	Ala	Ser	Arg	Asp	Leu	Ser	Glu	Asp	
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	Asn	Leu	Leu	Val	Leu	Thr	Pro	Ala	Phe	Leu	Val	Ser	Glu	Leu	Thr	Ala	
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25	ctc	atc	gta	tcg	aac	att	ctt	ctt	gcc	atg	gga	atg	atg	atg	gtt	tct	576
	Leu	Ile	Val	Ser	Asn	Ile	Leu	Leu	Ala	Met	Gly	Met	Met	Met	Val	Ser	
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	Pro	Val	Thr	Ile	Ser	Met	Pro	Leu	Lys	Leu	Phe	Leu	Phe	Val	Met	Val	
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	Pro	Pro	Asn	Met	ala	Leu	Tyr	Gly	Leu	Ala	Leu	Ile	Leu	Ser	Ala	Tyr	
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	Ala	Val	Leu	Gly	Val	Ala	Glu	Arg	Gly	Val	Gly	Pro	Leu	Arg	Ala	Phe	
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	Asn	Leu	Leu	Val	Leu	Thr	Pro	Ala	Phe	Leu	Val	Ser	Glu	Leu	Thr	Ala	
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Ala Phe Gln Leu Gly Phe Leu Leu Tyr Leu Pro Phe Ile Ile Ile Asp
165 170 175
Leu Ile Val Ser Asn Ile Leu Leu Ala Met Gly Met Met Met Val Ser
180 185 190
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Val Leu Trp Leu Ser Leu Pro Pro Ile Ala Val Val Ala Ile Val Gly
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30 acg ctg ttt tcc ctg ttg cag gcc ttg acg cag gtg cag gag cag acc 144
Thr Leu Phe Ser Leu Leu Gln Ala Leu Thr Gln Val Gln Glu Gln Thr
35 40 45

35 ctg tcc ttc gcc gtg aag ctg ata gcc gtg ttc gcc acg ctg atg ctg 192
Leu Ser Phe Ala Val Lys Leu Ile Ala Val Phe Ala Thr Leu Met Leu
50 55 60

gcg gcc cgg tgg ata agc gcg gaa atc tat aac ttc acg att gcg gtg 240
Ala Ala Arg Trp Ile Ser Ala Glu Ile Tyr Asn Phe Thr Ile Ala Val
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Phe Asp Ala Phe His Arg Ile His *
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55 Thr Leu Phe Ser Leu Leu Gln Ala Leu Thr Gln Val Gln Glu Gln Thr
35 40 45
Leu Ser Phe Ala Val Lys Leu Ile Ala Val Phe Ala Thr Leu Met Leu
50 55 60
60 Ala Ala Arg Trp Ile Ser Ala Glu Ile Tyr Asn Phe Thr Ile Ala Val
65 70 75 80

34

	tcg ccg gcc atc gtg gcc atg ttc ctg gcc gag ctg ggc ctg gcc ctg	624
	Ser Pro Ala Ile Val Ala Met Phe Leu Ala Glu Leu Gly Leu Ala Leu	
	195 200 205	
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	atc agc cgc ttc gcg cct caa ctg cag gtg ttc ttc ctg gct ctg ccg	672
	Ile Ser Arg Phe Ala Pro Gln Leu Gln Val Phe Phe Leu Ala Leu Pro	
	210 215 220	
10		
	gta aag agc gcg ctg gtg ctg ttc gtg ctg gtg ctg tac atg gca acg	720
	Val Lys Ser Ala Leu Val Leu Phe Val Leu Val Leu Tyr Met ala Thr	
	225 230 235 240	
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	ttg ttc cag tat gca ggc gaa atc ctg ggt tct gtg ggc cgg atc gtg	768
	Leu Phe Gln Tyr Ala Gly Glu Ile Leu Gly Ser Val Gly Arg Ile Val	
	245 250 255	
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	20 25 30	
	Met Phe Asn Arg Gln Phe Leu Pro Gly Pro Leu Arg Tyr Ala Val Gly	
	35 40 45	
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	Ala Leu Asp Ile Asp Trp Pro Arg Leu Leu Ala Leu Leu Ala Lys Glu	
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	Ile Phe Glu Ala Ile Gly Phe Val Ile Asp Asn Gln Arg Gly Ala Ser	
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	Leu Gly Ala Ile Leu Asn Pro Ala Thr Gly Asn Asp Ser Ser Pro Met	
	115 120 125	
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	Gly Ile Leu Phe Asn Leu Gly Phe Met Val Phe Phe Leu Thr Ala Gly	
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	Gly Phe Gly Leu Phe Ala Thr Met Leu Tyr Asp Ser Phe Gly Leu Trp	
	145 150 155 160	
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	165 170 175	
	Met Leu Asp Gln Phe Ser Gly Phe Ala Ala Arg Val Leu Leu Ala	
	180 185 190	
	Ser Pro Ala Ile Val Ala Met Phe Leu Ala Glu Leu Gly Leu Ala Leu	
	195 200 205	
55		
	Ile Ser Arg Phe Ala Pro Gln Leu Gln Val Phe Phe Leu Ala Leu Pro	
	210 215 220	
	Val Lys Ser Ala Leu Val Leu Phe Val Leu Val Leu Tyr Met ala Thr	
	225 230 235 240	
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 Ser Arg Glu Lys Gly Glu Val Ala His Ser Arg Asp Phe Thr Gln Thr
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25 gcg ctg ata tgc gcc ttg ttc ggg cac ttt ctg atc aat gcc ccg tcc 144
 Ala Leu Ile Cys Ala Leu Phe Gly His Phe Leu Ile Asn Ala Pro Ser
 35 40 45

att ctg gcg tcg ctg cga gcg ctg ata ctg gcg ccg gcg gcc ttt gcc 192
 Ile Leu Ala Ser Leu Arg Ala Leu Ile Leu Ala Pro Ala Ala Phe Ala
 50 55 60

30 gac cag ggg ttc gcc gtc gca ttg ggg ccc gtg ctg acg gaa atc ctc 240
 Asp Gln Gly Phe Ala Val Ala Leu Gly Pro Val Leu Thr Glu Ile Leu
 65 70 75 80

35 gat cag gcc gtc cgc gtg ctc gct ccg ctg att ctc atc gtg ctt ggg 288
 Asp Gln Ala Val Arg Val Leu Ala Pro Leu Ile Leu Ile Val Leu Gly
 85 90 95

40 gtg ggg atg ttc gcc gaa ttc ctg cag gta ggc gtc gtg ctg gcg ttt 336
 Val Gly Met Phe Ala Glu Phe Leu Gln Val Gly Val Val Leu Ala Phe
 100 105 110

45 cga aag ctc aag cct tcg gcg gag aaa ctg aat ccc gcc ggc aat ttg 384
 Arg Lys Leu Lys Pro Ser Ala Glu Lys Leu Asn Pro Ala Gly Asn Leu
 115 120 125

aag aat atc ttc tcg gcg cgc aac ctg atg gag ttc atc aag tcg gta 432
 Lys Asn Ile Phe Ser Ala Arg Asn Leu Met Glu Phe Ile Lys Ser Val
 130 135 140

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 Cys Lys Ile Leu Phe Leu Ala Val Leu Val Thr Leu Val Ile Arg Asp
 145 150 155 160

55 tcc ttg cag ccg ctg atg gcc gtt ccc cat agc ggg ctg gac ggg ttg 528
 Ser Leu Gln Pro Leu Met ala Val Pro His Ser Gly Leu Asp Gly Leu
 165 170 175

60 cga acg ggc gta ggc cgc att ctg cag gtc atg gtc tgg aac atc gga 576
 Arg Thr Gly Val Gly Arg Ile Leu Gln Val Met Val Trp Asn Ile Gly
 180 185 190

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10	cag tat cgc aaa ggc ttg cgg atg agc aag gac gaa gtg aag cag gag Gln Tyr Arg Lys Gly Leu Arg Met Ser Lys Asp Glu Val Lys Gln Glu 210 215 220	672
15	tac aag gag atg gaa ggc gat ccc cat atc aag cag caa cgc aag cac Tyr Lys Glu Met Glu Gly Asp Pro His Ile Lys Gln Gln Arg Lys His 225 230 235 240	720
20	ctg cac cag gag ctg atc atg cat ggc gcg gcg gcc cag gtt cgc cgg Leu His Gln Glu Leu Ile Met His Gly Ala Ala Ala Gln Val Arg Arg 245 250 255	768
25	gcg acg gtg ctg gtg acc aat ccg aca cac ctg gcc gtg gcc ctg tac Ala Thr Val Leu Val Thr Asn Pro Thr His Leu Ala Val Ala Leu Tyr 260 265 270	816
30	tac gcg gcg ggc gag acg ccc ttg ccg cgc gtg ctg gcc atg ggg cag Tyr Ala Ala Gly Glu Thr Pro Leu Pro Arg Val Leu Ala Met Gly Gln 275 280 285	864
35	gga gcc gtg gcc gct ctc atg gtc gag gcc gcg cgc gat gcc gcc gtg Gly Ala Val Ala Ala Leu Met Val Glu Ala Ala Arg Asp Ala Gly Val 290 295 300	912
40	ccg gtc atg cag aac gtc gcg ctg gcc cgc gcc ttg cac gac cag gcg Pro Val Met Gln Asn Val Ala Leu Ala Arg Ala Leu His Asp Gln Ala 305 310 315 320	960
45	gag gtg gac caa tac att ccc ggc gag ttg gtg gag ccg gtg gcc gcg Glu Val Asp Gln Tyr Ile Pro Gly Glu Leu Val Glu Pro Val Ala Ala 325 330 335	1008
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Val Gly Met Phe Ala Glu Phe Leu Gln Val Gly Val Val Leu Ala Phe
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 Arg Lys Leu Lys Pro Ser Ala Glu Lys Leu Asn Pro Ala Gly Asn Leu
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 130 135 140
 Cys Lys Ile Leu Phe Leu Ala Val Leu Val Thr Leu Val Ile Arg Asp
 145 150 155 160
 10 Ser Leu Gln Pro Leu Met ala Val Pro His Ser Gly Leu Asp Gly Leu
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 Arg Thr Gly Val Gly Arg Ile Leu Gln Val Met Val Trp Asn Ile Gly
 180 185 190
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 195 200 205
 15 Gln Tyr Arg Lys Gly Leu Arg Met Ser Lys Asp Glu Val Lys Gln Glu
 210 215 220
 Tyr Lys Glu Met Glu Gly Asp Pro His Ile Lys Gln Gln Arg Lys His
 225 230 235 240
 20 Leu His Gln Glu Leu Ile Met His Gly Ala Ala Ala Gln Val Arg Arg
 245 250 255
 Ala Thr Val Leu Val Thr Asn Pro Thr His Leu Ala Val Ala Leu Tyr
 260 265 270
 Tyr Ala Ala Gly Glu Thr Pro Leu Pro Arg Val Leu Ala Met Gly Gln
 275 280 285
 25 Gly Ala Val Ala Ala Leu Met Val Glu Ala Ala Arg Asp Ala Gly Val
 290 295 300
 Pro Val Met Gln Asn Val Ala Leu Ala Arg Ala Leu His Asp Gln Ala
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 20 25 30

 gac gga cgg cat cgc gtc agg ttg atc ccc gcc gaa gac ggc atg ctg 144
 55 Asp Gly Arg His Arg Val Arg Leu Ile Pro Ala Glu Asp Gly Met Leu
 35 40 45

 gtg ttg cgg gcg cgg ctg gcc gag ctg ccc gat ggg tgg cag gcg cgc 192
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 50 55 60

 gcg gcg cag ttg cgc cgg gcg ggc ctg ctg gcc agc gcc atg gcc cct 240

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	Ala	Thr	Asp	Ala	Tyr	Cys	Gly	Ile	Asp	Gln	Gly	Glu	Thr	Ala	Leu	Tyr	
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10	ctg	cac	cag	cgc	gtc	gca	ccg	gcc	ggc	agt	gcg	ctg	gcg	gtg	gac	gag	336
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	Val	Leu	Arg	Ala	Arg	Leu	Ala	Glu	Leu	Pro	Asp	Gly	Trp	Gln	Ala	Arg	
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	Ala	Thr	Asp	Ala	Tyr	Cys	Gly	Ile	Asp	Gln	Gly	Glu	Thr	Ala	Leu	Tyr	
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40	Leu	His	Gln	Arg	Val	Ala	Pro	Ala	Gly	Ser	Ala	Leu	Ala	Val	Asp	Glu	
				100					105					110			
	Ala	Val	Gly	Glu	Phe	Val	Asn	Ala	Leu	Ala	Thr	Trp	Lys	Arg	Ala	Met	
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	Asp	Asn	Ala	Tyr	Pro	Asp	Ile	Ala	Thr	Glu	Arg	Ser	Asp	Gln	Gln	Leu	
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	Leu	Ser	Ser	Leu	Val	Ala	Glu	His	Ala	Gly	Arg	Leu	Gln	Arg	Phe	Ile	
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	Ala	Lys	His	Ile	Gly	His	Ser	Ser	Asp	Val	Glu	Asp	Leu	Ala	Gln	Gln	
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15	gct	ttc	gcc	gag	gcg	gcg	cgc	gcg	tat	caa	tcg	ttc	cgt	ggc	gac	tcc	240
	Ala	Phe	Ala	Glu	Ala	Ala	Arg	Ala	Tyr	Gln	Ser	Phe	Arg	Gly	Asp	Ser	
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20	cag	ctt	tcc	acc	tgg	ctg	tac	ggc	atc	gcg	ctc	aat	ctg	gtc	cgc	aat	288
	Gln	Leu	Ser	Thr	Trp	Leu	Tyr	Gly	Ile	Ala	Leu	Asn	Leu	Val	Arg	Asn	
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25	cac	ttg	tcg	cgt	gcg	cca	gag	cgc	cgt	tat	gaa	ttc	acc	tcc	gac	gcc	336
	His	Leu	Ser	Arg	Ala	Pro	Glu	Arg	Arg	Tyr	Glu	Phe	Thr	Ser	Asp	Ala	
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	Ser	Leu	Gly	Val	Met	Pro	Cys	Ser	Ala	Pro	Asn	Pro	Glu	Ala	Val	Thr	
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	Glu	Gln	Arg	Gln	Arg	Met	Arg	Leu	Leu	Arg	Glu	Ala	Leu	Glu	Gln	Leu	
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40	ccc	gaa	agc	atg	cgc	gac	gtg	atc	ctc	atg	gtc	ggc	gtg	gaa	gaa	ctc	480
	Pro	Glu	Ser	Met	Arg	Asp	Val	Ile	Leu	Met	Val	Gly	Val	Glu	Glu	Leu	
	145					150					155					160	
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	Ser	Tyr	Glu	Glu	Ala	Ala	Ala	Leu	Leu	Ser	Val	Pro	Val	Gly	Thr	Ile	
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	Arg	Ser	Arg	Leu	Ser	Arg	Ala	Arg	Cys	Ala	Leu	Arg	Glu	Ala	Leu	Arg	
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55	gaa	cga	ggc	tac	gac	agc	gtg	ccg	tag								603
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	Leu	Ser	Ser	Leu	Val	Ala	Glu	His	Ala	Gly	Arg	Leu	Gln	Arg	Phe	Ile	
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	His	Leu	Ser	Arg	Ala	Pro	Glu	Arg	Arg	Tyr	Glu	Phe	Thr	Ser	Asp	Ala	
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	Gly	Arg	His	Asp	Ala	Ser	Ala	Asn	Thr	Ser	Ser	Gly	Trp	Leu	Gln	Gly	
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	Gln	Arg	Ile	Ala	Pro	Ala	Pro	Thr	Gly	Ile	Ser	Leu	Ala	Asp	Ala	Ala	
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	Glu	Glu	Leu	Ser	Leu	His	Met	ala	Gln	Ala	Ala	Glu	Glu	Lys	His	His	
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	gcg	cag	ctt	gcg	gaa	ctg	ttt	tcc	cac	acc	cac	gac	ccc	gac	gcg	cag	288
	Ala	Gln	Leu	Ala	Glu	Leu	Phe	Ser	His	Thr	His	Asp	Pro	Asp	Ala	Gln	
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	Ala	Lys	Leu	Ala	Ala	Leu	Thr	Ala	Glu	Leu	Leu	Arg	Gly	Arg	Gly	Ala	
				100					105					110			
60	ccc	atg	cag	ctg	gcc	gcg	caa	gcg	ttt	ccc	ggt	gtc	acg	cag	caa	tac	384

	Pro	Met	Gln	Leu	Ala	Ala	Gln	Ala	Phe	Pro	Gly	Val	Thr	Gln	Gln	Tyr	
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	Leu	Ala	Leu	Gln	His	Ala	Leu	Gln	Arg	Gly	Glu	His	Glu	Asp	Ala	Ala	
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10	ccg	cac	gcg	ctc	gaa	gcc	ctg	cgc	gat	gca	ttg	gcc	gac	ctg	gag	ctc	480
	Pro	His	Ala	Leu	Glu	Ala	Leu	Arg	Asp	Ala	Leu	Ala	Asp	Leu	Glu	Leu	
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15	gcc	cat	ggc	ccc	gaa	atc	cgc	gcc	ggc	atc	aac	acc	ctg	ccc	acg	gcc	528
	Ala	His	Gly	Pro	Glu	Ile	Arg	Ala	Gly	Ile	Asn	Thr	Leu	Pro	Thr	Ala	
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	ggc	gca	ttc	gcg	cgt	tcc	gct	gac	gag	ctg	gcc	ggc	ttc	cag	cac	gcg	576
	Gly	Ala	Phe	Ala	Arg	Ser	Ala	Asp	Glu	Leu	Ala	Gly	Phe	Gln	His	Ala	
					180				185					190			
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	Tyr	Arg	Asp	Ile	Ala	Leu	Gly	Gln	Leu	Ser	Leu	Ala	Arg	Thr	Leu	Asp	
			195					200					205				
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	Leu	Val	Leu	Glu	Arg	Tyr	Gly	Asn	Asp	Asp	Ile	His	Gly	Ala	Leu	Gly	
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	Ala	Leu	Ile	Gln	Ala	Leu	Gly	His	Asp	Leu	Ala	Ala	Ala	Thr	Pro	Ser	
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35	acg	gac	ggc	gtc	agg	ctg	caa	gtg	ttg	gcg	agc	gat	ctc	tat	caa	gtc	768
	Thr	Asp	Gly	Val	Arg	Leu	Gln	Val	Leu	Ala	Ser	Asp	Leu	Tyr	Gln	Val	
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	Glu	Val	Ala	Ala	Thr	Val	Leu	Glu	Glu	Cys	Asn	Ala	Leu	Lys	Gln	Arg	
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40	ttg	ggc	aac	gca	ggc	tcg	cag	gag	tgt	gcg	gac	gcc	cag	ggc	ctg	atg	864
	Leu	Gly	Asn	Ala	Gly	Ser	Gln	Glu	Cys	Ala	Asp	Ala	Gln	Gly	Leu	Met	
			275				280						285				
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	Arg	Asp	Leu	Val	Gly	Ile	Ser	Glu	Asp	Lys	Trp	Ile	Ala	Pro	Ala	Arg	
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	Phe	Glu	Lys	Leu	Ala	Glu	Arg	His	Gly	Ala	Asn	Ala	Leu	Ser	Glu	Arg	
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	Ile	Ala	Phe	Leu	Gly	Gly	Val	Arg	Gln	Ile	Leu	Lys	Asp	Leu	Pro	Thr	
					325					330					335		
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	Gln	Ile	Tyr	Ala	Asp	Met	Asp	Val	Arg	Ala	Thr	Val	Leu	Ala	Ala	Ala	
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 35 40 45
 Glu Glu Leu Ser Leu His Met ala Gln Ala Ala Glu Glu Lys His His
 50 55 60
 Ser Glu Arg Lys Val Thr Ala Glu Arg Pro Met Leu Trp Leu Asp Ala
 65 70 75 80
 20 Ala Gln Leu Ala Glu Leu Phe Ser His Thr His Asp Pro Asp Ala Gln
 85 90 95
 Ala Lys Leu Glu Ala Leu Thr Ala Glu Leu Leu Arg Gly Arg Gly Ala
 100 105 110
 25 Pro Met Gln Leu Ala Ala Gln Ala Phe Pro Gly Val Thr Gln Gln Tyr
 115 120 125
 Leu Ala Leu Gln His Ala Leu Gln Arg Gly Glu His Glu Asp Ala Ala
 130 135 140
 30 Pro His Ala Leu Glu Ala Leu Arg Asp Ala Leu Ala Asp Leu Glu Leu
 145 150 155 160
 Ala His Gly Pro Glu Ile Arg Ala Gly Ile Asn Thr Leu Pro Thr Ala
 165 170 175
 Gly Ala Phe Ala Arg Ser Ala Asp Glu Leu Ala Gly Phe Gln His Ala
 180 185 190
 35 Tyr Arg Asp Ile Ala Leu Gly Gln Leu Ser Leu Ala Arg Thr Leu Asp
 195 200 205
 Leu Val Leu Glu Arg Tyr Gly Asn Asp Asp Ile His Gly Ala Leu Gly
 210 215 220
 40 Ala Leu Ile Gln Ala Leu Gly His Asp Leu Ala Ala Ala Thr Pro Ser
 225 230 235 240
 Thr Asp Gly Val Arg Leu Gln Val Leu Ala Ser Asp Leu Tyr Gln Val
 245 250 255
 Glu Val Ala Ala Thr Val Leu Glu Glu Cys Asn Ala Leu Lys Gln Arg
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 45 Leu Gly Asn Ala Gly Ser Gln Glu Cys Ala Asp Ala Gln Gly Leu Met
 275 280 285
 Arg Asp Leu Val Gly Ile Ser Glu Asp Lys Trp Ile Ala Pro Ala Arg
 290 295 300
 50 Phe Glu Lys Leu Ala Glu Arg His Gly Ala Asn Ala Leu Ser Glu Arg
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 Ile Ala Phe Leu Gly Gly Val Arg Gln Ile Leu Lys Asp Leu Pro Thr
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	Pro Leu Leu Pro Arg Ile Ser Ser Val Trp Phe Pro Leu Arg Pro Thr	
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25	cag gct cgc ctc gcc atg acc gac acg gca tac cac caa ctc atc gcc	192
	Gln Ala Arg Leu Ala Met Thr Asp Thr Ala Tyr His Gln Leu Ile Ala	
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30	gat ttc ggc cgc ctc atc ggc atc gac tgc ctc aac ccc ggt gcc ggc	240
	Asp Phe Gly Arg Leu Ile Gly Ile Asp Ser Leu Asn Pro Gly Ala Gly	
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35	ggc ctg tgt cag ttg att ttc gaa ccg tgc gca ccg gtc ttc atc gca	288
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	Pro Val His Ala Arg Thr Glu Ile Met Ile Ser Cys Val Leu Gly Thr	
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	Ala Gly Ser Gly Val Val Ala Cys Ile Gly Gly Asp Gly Leu Phe Tyr	
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	Leu Gln Gln Ala Ile Pro Leu Ser Arg Ala Thr Pro Ala Ile Leu Leu	
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	Asp His Cys Glu Arg Leu Leu Gln Glu Ala Ser Arg Trp Arg Val Gly	
	165 170 175	
55	gac cac gac ggc tgc gcc acc tgc gcc ccg aat atc gcc gcg ctg acg	576
	Asp His Asp Gly Cys Ala Thr Ser Ala Pro Asn Ile Ala Leu Thr	
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60	cgc ggc gtc tag	588
	Arg Gly Val *	
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	85 90 95	
10	cga ccc gac gac gcc cgc cag gcc atg cgt gac tat atg gcg cta cgg Arg Pro Asp Asp Ala Arg Gln Ala Met Arg Asp Tyr Met ala Leu Arg	336
	100 105 110	
15	gcg gcg tct tgc gcg agc gcg acc ccg cca tga Ala Ala Ser Cys Ala Ser Ala Thr Pro Pro *	369
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5 gac gag tcg gcg cgg cct cgc ctg acg gat ggc gca tta ttc cag ccc 240
 Asp Glu Ser Ala Arg Pro Arg Leu Thr Asp Gly Ala Leu Phe Gln Pro
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 Ala Gln Phe Glu Arg Ala Leu Ala Gln Ala Arg Asp Glu Leu Ser Arg
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 Ala Met Glu Leu His Ala Gly Asn Thr Ala Pro Ala Leu Ser Arg Ala
 100 105 110

20 ttg cac gta ctc aac gag gcc gga aag ctg cgc gac ctg gct gcc atg 384
 Leu His Val Leu Asn Glu Ala Gly Lys Leu Arg Asp Leu Ala Ala Met
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25 tat cgc agc gcg ctc tac cag gga tga 411
 Tyr Arg Ser Ala Leu Tyr Gln Gly *
 130 135

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 Thr Leu Pro Pro Glu Arg Trp Leu Glu Pro Pro Ala Thr Gly Ala Val
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 40 Asp His Leu Lys Ala Leu Leu Val Arg Pro Asp Leu Ser Ala Met Leu
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 Asp Glu Ser Ala Arg Pro Arg Leu Thr Asp Gly Ala Leu Phe Gln Pro
 65 70 75 80
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 Ile Glu Gly Leu Ala Phe Gly Pro Ser Gly Ser Ala Ser Leu Ala Leu
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 tcc aac ggg cgc cgc ctg ggc gtc gaa tgc gtc gcc ggc gcg gcc ctg 144
 Ser Asn Gly Arg Arg Leu Gly Val Glu Cys Val Ala Gly Ala Ala Leu
 35 40 45
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 Val His Leu Ala Gln Arg Val Glu Arg Asp Ala Ala Ser Val Leu Leu
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 gcg gca tgg aaa cgg gcc cat ggg cag cgc gga agc gcc gca tcc atc 240
 Ala Ala Trp Lys Arg Ala His Gly Gln Arg Gly Ser Ala Ala Ser Ile
 65 70 75 80
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 Gln Thr Ser Leu Trp Ser Glu Gly Ser Glu Asp Trp Ile Val Ala Gln
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 Thr Arg Leu Pro Glu Arg Ser Leu Asp Ala Ala Ala Leu Arg Leu Ala
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 Ser Asn Gly Arg Arg Leu Gly Val Glu Cys Val Ala Gly Ala Ala Leu
 35 40 45
 Val His Leu Ala Gln Arg Val Glu Arg Asp Ala Ala Ser Val Leu Leu
 50 55 60
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 Ala Ala Trp Lys Arg Ala His Gly Gln Arg Gly Ser Ala Ala Ser Ile
 65 70 75 80
 Gln Thr Ser Leu Trp Ser Glu Gly Ser Glu Asp Trp Ile Val Ala Gln
 85 90 95
 Thr Arg Leu Pro Glu Arg Ser Leu Asp Ala Ala Ala Leu Arg Leu Ala
 100 105 110
 55
 Val Leu Gly Leu Thr Asn Trp Leu Asp Arg Leu Glu Ala
 115 120 125
 60
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 <211> 783
 <212> DNA

<213> Bordetella pertussis

<220>

<221> CDS

5 <222> (1)...(783)

<400> 51

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	Met Gly Ser Pro Arg Arg Arg Asn His Leu Pro Thr Gly Ala Val Ser	
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15	gtc gcg cgc gcg gtc atg gtt ccc gga aac ggg cgc gat att ggg caa	96
	Val Ala Arg Ala Val Met Val Pro Gly Asn Gly Arg Asp Ile Gly Gln	
	20 25 30	
20	ttc gca gcc tgg aac ttg ccg cgg gcg cag ggt tac tca gca tgc gtc	144
	Phe Ala Ala Trp Asn Leu Pro Arg Ala Gln Gly Tyr Ser Ala Cys Val	
	35 40 45	
25	ttt caa ctc gaa gga gct ctc atg agc att gat ctc gga gtt tca ctc	192
	Phe Gln Leu Glu Gly Ala Leu Met Ser Ile Asp Leu Gly Val Ser Leu	
	50 55 60	
30	acg tcg cag gcc ggc ggc ctg caa ggc atc gac ctc aag agc atg gat	240
	Thr Ser Gln Ala Gly Gly Leu Gln Gly Ile Asp Leu Lys Ser Met Asp	
	65 70 75 80	
35	atc cag act ctc atg gtg tat gtg cag ggt cgt cgc gcc gaa ctc ctc	288
	Ile Gln Thr Leu Met Val Tyr Val Gln Gly Arg Arg Ala Glu Leu Leu	
	85 90 95	
40	acg gct caa atg cag acc cag gcc gaa gtg gtg cag aag gcc aat gaa	336
	Thr Ala Gln Met Gln Thr Gln Ala Glu Val Val Gln Lys Ala Asn Glu	
	100 105 110	
45	cgc atg gcg cag ctc aac gag gtc ctg tcc gcg ctg tcc cgg gcc aag	384
	Arg Met ala Gln Leu Asn Glu Val Leu Ser Ala Leu Ser Arg Ala Lys	
	115 120 125	
50	gcc gag ttt ccg ccc aat ccg aag ccg ggc gac acc atc ccg ggc tgg	432
	Ala Glu Phe Pro Pro Asn Pro Lys Pro Gly Asp Thr Ile Pro Gly Trp	
	130 135 140	
55	gac agc cag aag atc agc cgg atc gag gtt cct ctc aat gat gcg ctg	480
	Asp Ser Gln Lys Ile Ser Arg Ile Glu Val Pro Leu Asn Asp Ala Leu	
	145 150 155 160	
60	cgt gcc gcc ggc ctg acg ggc atg ttc gaa gcg cgc gat ggc cgg gtg	528
	Arg Ala Ala Gly Leu Thr Gly Met Phe Glu Ala Arg Asp Gly Arg Val	
	165 170 175	
55	acc ggc ccc gac ggc cgg ggt acg cag gtc gtg aac ggc acg ggc gtc	576
	Thr Gly Pro Asp Gly Arg Gly Thr Gln Val Val Asn Gly Thr Gly Val	
	180 185 190	
60	atg gcc ggt tcc acg acc tat aag gaa ctc gaa agt gcc tac acc acc	624
	Met ala Gly Ser Thr Thr Tyr Lys Glu Leu Glu Ser Ala Tyr Thr Thr	
	195 200 205	
60	gta aag ggg atg ctg gat acg gcg tcc aat acg caa cag atg gac atg	672

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Val Lys Gly Met Leu Asp Thr Ala Ser Asn Thr Gln Gln Met Asp Met
 210 215 220

5 atc agg ctg cag gcc gcc agc aac aag cgc aac gag gct ttc gag gtc 720
 Ile Arg Leu Gln Ala Ala Ser Asn Lys Arg Asn Glu Ala Phe Glu Val
 225 230 235 240

10 atg acc aac acc gag aag cgg cgc agc gac ttg aac agc tcc atc acc 768
 Met Thr Asn Thr Glu Lys Arg Arg Ser Asp Leu Asn Ser Ser Ile Thr
 245 250 255

15 agc aac atg cgc taa 783
 Ser Asn Met Arg *
 260

20 <210> 52
 <211> 260
 <212> PRT
 <213> Bordetella pertussis

25 <400> 52
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 20 25 30
 Phe Ala Ala Trp Asn Leu Pro Arg Ala Gln Gly Tyr Ser Ala Cys Val
 35 40 45
 30 Phe Gln Leu Glu Gly Ala Leu Met Ser Ile Asp Leu Gly Val Ser Leu
 50 55 60
 Thr Ser Gln Ala Gly Gly Leu Gln Gly Ile Asp Leu Lys Ser Met Asp
 65 70 75 80
 Ile Gln Thr Leu Met Val Tyr Val Gln Gly Arg Arg Ala Glu Leu Leu
 85 90 95
 35 Thr Ala Gln Met Gln Thr Gln Ala Glu Val Val Gln Lys Ala Asn Glu
 100 105 110
 Arg Met ala Gln Leu Asn Glu Val Leu Ser Ala Leu Ser Arg Ala Lys
 115 120 125
 40 Ala Glu Phe Pro Pro Asn Pro Lys Pro Gly Asp Thr Ile Pro Gly Trp
 130 135 140
 Asp Ser Gln Lys Ile Ser Arg Ile Glu Val Pro Leu Asn Asp Ala Leu
 145 150 155 160
 Arg Ala Ala Gly Leu Thr Gly Met Phe Glu Ala Arg Asp Gly Arg Val
 165 170 175
 45 Thr Gly Pro Asp Gly Arg Gly Thr Gln Val Val Asn Gly Thr Gly Val
 180 185 190
 Met ala Gly Ser Thr Thr Tyr Lys Glu Leu Glu Ser Ala Tyr Thr Thr
 195 200 205
 50 Val Lys Gly Met Leu Asp Thr Ala Ser Asn Thr Gln Gln Met Asp Met
 210 215 220
 Ile Arg Leu Gln Ala Ala Ser Asn Lys Arg Asn Glu Ala Phe Glu Val
 225 230 235 240
 Met Thr Asn Thr Glu Lys Arg Arg Ser Asp Leu Asn Ser Ser Ile Thr
 245 250 255

55 Ser Asn Met Arg 260

60 <210> 53
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    <220>
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5    <222> (1)...(276)

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        1          5          10          15

      gtc gag cag acc cgc cag gcg ttg tac agc gtc gac gag atc tac gcc      96
      Val Glu Gln Thr Arg Gln Ala Leu Tyr Ser Val Asp Glu Ile Tyr Ala
                20          25          30

15    cac gtt ggc gtc gac ccc gct cgc ctg cgc aat ctg gcg gtc gag cag      144
      His Val Gly Val Asp Pro Ala Arg Leu Arg Asn Leu Ala Val Glu Gln
                35          40          45

20    gcc agg ata gag gcc gag gcc cag gcg gcg ttc cgt gat gac ctc gcg      192
      Ala Arg Ile Glu Ala Glu Ala Gln Ala Ala Phe Arg Asp Asp Leu Ala
                50          55          60

25    gac atc gag cgc gag gcg gcg cgc gtc aag gcg gcc tgc acc gat gcg      240
      Asp Ile Glu Arg Glu Ala Ala Arg Val Lys Ala Ala Cys Thr Asp Ala
        65          70          75          80

30    ccg cag gcc cgc agg gtg ctt cac aac cac gtc tga      276
      Pro Gln Ala Arg Arg Val Leu His Asn His Val *
                85          90

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    <211> 91
35    <212> PRT
    <213> Bordetella pertussis

    <400> 54
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      1          5          10          15
    Val Glu Gln Thr Arg Gln Ala Leu Tyr Ser Val Asp Glu Ile Tyr Ala
      20          25          30
    His Val Gly Val Asp Pro Ala Arg Leu Arg Asn Leu Ala Val Glu Gln
      35          40          45
45    Ala Arg Ile Glu Ala Glu Ala Gln Ala Ala Phe Arg Asp Asp Leu Ala
      50          55          60
    Asp Ile Glu Arg Glu Ala Ala Arg Val Lys Ala Ala Cys Thr Asp Ala
      65          70          75          80
50    Pro Gln Ala Arg Arg Val Leu His Asn His Val
      85          90

    <210> 55
    <211> 942
    <212> DNA
55    <213> Bordetella pertussis

    <220>
    <221> CDS
60    <222> (1)...(942)

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53

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	Ala	Ser	Arg	Arg	Ala	Asp	Glu	Ala	Met	Gln	Gln	Met	Leu	Asp	Ile	Ile	
			275					280						285			
5	Arg	Gly	Ile	Arg	Glu	Lys	Leu	Ala	Gly	Met	Glu	Gln	Ser	Arg	Ser	Glu	
		290					295					300					
	Thr	Ala	Arg	Ser	Val	Ala	Arg	Asn	Ile								
	305					310											
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			<211>	1203													
			<212>	DNA													
			<213>	Bordetella pertussis													
15			<220>														
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			<222>	(1)...(1203)													
20			<400>	57													
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	Met	Thr	Val	Met	Ser	Thr	Thr	Ile	Ser	Thr	Ala	Pro	Ser	Gly	Ala	Ala	
	1				5					10					15		
25	ctt	gcg	ccg	tct	cgc	ata	gat	atg	cgg	gcg	ccg	gag	ccc	ggg	agt	gcc	96
	Leu	Ala	Pro	Ser	Arg	Ile	Asp	Met	Arg	Ala	Pro	Glu	Pro	Gly	Ser	Ala	
				20					25					30			
30	ggc	gaa	ggc	gcc	ggt	atc	ctg	gcg	ccg	gtg	acg	acg	ctg	gct	ctg	gcg	144
	Gly	Glu	Gly	Ala	Gly	Ile	Leu	Ala	Pro	Val	Thr	Thr	Leu	Ala	Leu	Ala	
			35					40					45				
35	gcg	ggc	ccg	ccg	gct	ttg	cca	gcg	tca	ccg	tcg	ctg	cgc	acc	gcg	ccc	192
	Ala	Gly	Arg	Pro	Ala	Leu	Pro	Ala	Ser	Pro	Ser	Leu	Arg	Thr	Ala	Pro	
		50					55					60					
40	gtc	ctg	gat	ccg	cca	gtg	cgc	gat	ctc	agc	ccc	gcc	gac	ttg	gcc	gac	240
	Val	Leu	Asp	Pro	Pro	Val	Arg	Asp	Leu	Ser	Pro	Ala	Asp	Leu	Ala	Asp	
	65					70					75					80	
45	ctg	ctg	cgc	gtc	ttg	cga	tcc	agg	gcg	gtg	gac	ggg	cag	ttg	gcc	acg	288
	Leu	Leu	Arg	Val	Leu	Arg	Ser	Arg	Ala	Val	Asp	Gly	Gln	Leu	Ala	Thr	
					85					90					95		
50	gcg	cgc	gag	aac	ctg	cag	gat	gcg	caa	gtc	aag	gcg	aag	cag	aac	acc	336
	Ala	Arg	Glu	Asn	Leu	Gln	Asp	Ala	Gln	Val	Lys	Ala	Lys	Gln	Asn	Thr	
				100					105					110			
55	cag	gcc	cag	ctc	gac	aag	ctg	gac	gca	tgg	ttt	cgg	aag	gct	gag	gac	384
	Gln	Ala	Gln	Leu	Asp	Lys	Leu	Asp	Ala	Trp	Phe	Arg	Lys	Ala	Glu	Asp	
			115					120									

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	Ala Ser Val Val Thr Gly Ala Ala Ala Thr Pro Met Leu Val Leu Ser	
	165 170 175	
5	ggc atg gca ttg gtc agc gcc gtg aca tcg ctg gcc gac cag ata tcg Gly Met ala Leu Val Ser Ala Val Thr Ser Leu Ala Asp Gln Ile Ser	576
	180 185 190	
10	cga gag gcg gga ggg ccg cct atc agc ctg gcc ggg ttt ctc tcc ggg Arg Glu Ala Gly Gly Pro Pro Ile Ser Leu Gly Gly Phe Leu Ser Gly	624
	195 200 205	
15	ctg gcc gga cgt ctg ctg aca gcg ttg ggg gtg gat cag tcg cag gcc Leu Ala Gly Arg Leu Leu Thr Ala Leu Gly Val Asp Gln Ser Gln Ala	672
	210 215 220	
20	gac caa att gcc aag atc gtc gcc ggc ctg gcc gtg ccc gcc gtc ttg Asp Gln Ile Ala Lys Ile Val Ala Gly Leu Ala Val Pro Ala Val Leu	720
	225 230 235 240	
25	ctg atc gaa ccc cag atg ctg gcc gaa atg gcc gaa ggc gtg gcc agg Leu Ile Glu Pro Gln Met Leu Gly Glu Met ala Glu Gly Val Ala Arg	768
	245 250 255	
30	ctg gcg ggc gcc ggc gat gcc acc gcg gga tac ata gcc atg gcg atg Leu Ala Gly Ala Gly Asp Ala Thr Ala Gly Tyr Ile Ala Met ala Met	816
	260 265 270	
35	tcc atc gtg gcg gcg atc gcg gtc gcc gcg atc aat gcc gcc ggt acg Ser Ile Val Ala Ala Ile Ala Val Ala Ala Ile Asn Ala Ala Gly Thr	864
	275 280 285	
40	gcc ggc gcg ggc agc gcc tcg gcg atc agg ggt gcc tgg gat cgg gcc Ala Gly Ala Gly Ser Ala Ser Ala Ile Arg Gly Ala Trp Asp Arg Ala	912
	290 295 300	
45	gcc gcg gta gcc acc cag gtc ctt cag ggg ggt acg gca gtg gcg caa Ala Ala Val Ala Thr Gln Val Leu Gln Gly Gly Thr Ala Val Ala Gln	960
	305 310 315 320	
50	ggc ggc gtc ggc gtg tcg atg gca gtc gat cgc aaa cag gcc gat ctc Gly Gly Val Gly Val Ser Met ala Val Asp Arg Lys Gln Ala Asp Leu	1008
	325 330 335	
55	ctg gtc gcc gac aag gcg gat ctg gcg gcg agc ctg aca aaa ctg cgg Leu Val Ala Asp Lys Ala Asp Leu Ala Ala Ser Leu Thr Lys Leu Arg	1056
	340 345 350	
60	gcg gcc atg gag cgt gag gcg gac gat atc aag aag atc ctg gct caa Ala Ala Met Glu Arg Glu Ala Asp Asp Ile Lys Lys Ile Leu Ala Gln	1104
	355 360 365	
65	ttc gac gcg gcc tat cac atg atc gcg cag atg atc agc gac atg gcg Phe Asp Ala Ala Tyr His Met Ile Ala Gln Met Ile Ser Asp Met ala	1152
	370 375 380	
70	agc acg cac agc cag gtc agc gcc aac ctc gga cgg cgc cag gcg gtg Ser Thr His Ser Gln Val Ser Ala Asn Leu Gly Arg Arg Gln Ala Val	1200
	385 390 395 400	
75	tag	1203

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<210> 58
 <211> 400
 <212> PRT
 5 <213> Bordetella pertussis

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 1 5 10 15
 10 Leu Ala Pro Ser Arg Ile Asp Met Arg Ala Pro Glu Pro Gly Ser Ala
 20 25 30
 Gly Glu Gly Ala Gly Ile Leu Ala Pro Val Thr Thr Leu Ala Leu Ala
 35 40 45
 15 Ala Gly Arg Pro Ala Leu Pro Ala Ser Pro Ser Leu Arg Thr Ala Pro
 50 55 60
 Val Leu Asp Pro Pro Val Arg Asp Leu Ser Pro Ala Asp Leu Ala Asp
 65 70 75 80
 Leu Leu Arg Val Leu Arg Ser Arg Ala Val Asp Gly Gln Leu Ala Thr
 85 90 95
 20 Ala Arg Glu Asn Leu Gln Asp Ala Gln Val Lys Ala Lys Gln Asn Thr
 100 105 110
 Gln Ala Gln Leu Asp Lys Leu Asp Ala Trp Phe Arg Lys Ala Glu Asp
 115 120 125
 25 Ala Glu Ser Lys Gly Trp Leu Ser Lys Val Phe Gly Trp Ile Gly Lys
 130 135 140
 Val Leu Ala Val Val Ala Ser Ala Leu Ala Val Gly Phe Ala Ala Val
 145 150 155 160
 Ala Ser Val Val Thr Gly Ala Ala Ala Thr Pro Met Leu Val Leu Ser
 165 170 175
 30 Gly Met ala Leu Val Ser Ala Val Thr Ser Leu Ala Asp Gln Ile Ser
 180 185 190
 Arg Glu Ala Gly Gly Pro Pro Ile Ser Leu Gly Gly Phe Leu Ser Gly
 195 200 205
 35 Leu Ala Gly Arg Leu Leu Thr Ala Leu Gly Val Asp Gln Ser Gln Ala
 210 215 220
 Asp Gln Ile Ala Lys Ile Val Ala Gly Leu Ala Val Pro Ala Val Leu
 225 230 235 240
 Leu Ile Glu Pro Gln Met Leu Gly Glu Met ala Glu Gly Val Ala Arg
 245 250 255
 40 Leu Ala Gly Ala Gly Asp Ala Thr Ala Gly Tyr Ile Ala Met ala Met
 260 265 270
 Ser Ile Val Ala Ala Ile Ala Val Ala Ala Ile Asn Ala Ala Gly Thr
 275 280 285
 45 Ala Gly Ala Gly Ser Ala Ser Ala Ile Arg Gly Ala Trp Asp Arg Ala
 290 295 300
 Ala Ala Val Ala Thr Gln Val Leu Gln Gly Gly Thr Ala Val Ala Gln
 305 310 315 320
 Gly Gly Val Gly Val Ser Met ala Val Asp Arg Lys Gln Ala Asp Leu
 325 330 335
 50 Leu Val Ala Asp Lys Ala Asp Leu Ala Ala Ser Leu Thr Lys Leu Arg
 340 345 350
 Ala Ala Met Glu Arg Glu Ala Asp Asp Ile Lys Lys Ile Leu Ala Gln
 355 360 365
 55 Phe Asp Ala Ala Tyr His Met Ile Ala Gln Met Ile Ser Asp Met ala
 370 375 380
 Ser Thr His Ser Gln Val Ser Ala Asn Leu Gly Arg Arg Gln Ala Val
 385 390 395 400

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 60 <211> 462


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<212> DNA
<213> Bordetella pertussis
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Met Thr Val His Asp Asp Ala Ala Ala Ala Leu Arg Ala Arg Leu Asp 48

1 5 10 15

gcg ttg ccg ggc agc cgg cgc ctg aca gcc gag caa ttg gaa gtg att
Ala Leu Pro Gly Ser Arg Arg Leu Thr Ala Glu Gln Leu Glu Val Ile 96

15 20 25 30

20 tac gcg atg gcg tat gcg cac gtc gcc agg tgc gag tac gcc aag gcg 144
Tyr Ala Met ala Tyr Ala His Val Ala Arg Cys Glu Tyr Gly Lys Ala

35 40 45

ctg ccc att ttc gcc ttc ctc gcg cag tac ggc ccc acg cgc aag cac 192
Leu Pro Ile Phe Ala Phe Leu Ala Gln Tyr Gly Pro Thr Arg Lys His
50 55 60

25 tac tgg gcc ggc ctg gcg cta tgc ctg cag aag acc gac cgt ccc gac 240
Tyr Trp Ala Gly Leu Ala Leu Cys Leu Gln Lys Thr Asp Arg Pro Asp
65 70 75 80

30 gag gcg cgc aat atc tat gcg ttg atc ctc acg ctc tat cca gat tcc 288
Glu Ala Arg Asn Ile Tyr Ala Leu Ile Leu Thr Leu Tyr Pro Asp Ser
85 90 95

gcg gat gcc gtg ttg cgc acg gcc gag tgc gag ctg gcg ttg ggt gag
Ala Asp Ala Val Leu Arg Thr Ala Glu Cys Glu Leu Ala Leu Gly Glu

35 100 105 110 336

aac gaa cgg gcg cag gcg gcc ctg ttc ggc gca atc gcc atc gat gca 384
 Asn Glu Arg Ala Gln Ala Ala Leu Phe Gly Ala Ile Ala Ile Asp Ala
 115 120 125

gaa agt ggg cag cca ggt ccg gtc tgc cac cgt gcg cgc gct ttg ctc 432
Glu Ser Gly Gln Pro Gly Pro Val Ser His Arg Ala Arg Ala Leu Leu
130 135 140

45 gat ctt att tca gtt tca cat ccg gag taa
Asp Leu Ile Ser Val Ser His Pro Glu * 462
145 150

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50      <210> 60
      <211> 153
      <212> PRT
      <213> Bordetella pertussis
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55      <400> 60
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      1      5      10
      Ala Leu Pro Gly Ser Arg Arg Leu Thr Ala Glu Gln Leu Glu Val Ile
      20      25      30
60      Tyr Ala Met ala Tyr Ala His Val Ala Arg Cys Glu Tyr Gly Lys Ala

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35 40 45
 Leu Pro Ile Phe Ala Phe Leu Ala Gln Tyr Gly Pro Thr Arg Lys His
 50 55 60
 Tyr Trp Ala Gly Leu Ala Leu Cys Leu Gln Lys Thr Asp Arg Pro Asp
 65 70 75 80
 Glu Ala Arg Asn Ile Tyr Ala Leu Ile Leu Thr Leu Tyr Pro Asp Ser
 85 90 95
 Ala Asp Ala Val Leu Arg Thr Ala Glu Cys Glu Leu Ala Leu Gly Glu
 100 105 110
 10 Asn Glu Arg Ala Gln Ala Ala Leu Phe Gly Ala Ile Ala Ile Asp Ala
 115 120 125
 Glu Ser Gly Gln Pro Gly Pro Val Ser His Arg Ala Arg Ala Leu Leu
 130 135 140
 15 Asp Leu Ile Ser Val Ser His Pro Glu
 145 150

 <210> 61
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 <212> DNA
 20 <213> Bordetella pertussis

 <220>
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 1 5 10 15
 30 tca ccc atg gtc tcg tcg ata cat cca tcg gaa ccg ata cag ccg atg 96
 Ser Pro Met Val Ser Ser Ile His Pro Ser Glu Pro Ile Gln Pro Met
 20 25 30
 35 gag cat gtg ctc gag gag gcc gac gcc cgc ctg ctt acc gaa gtg ggt 144
 Glu His Val Leu Glu Glu Ala Asp Ala Arg Leu Leu Thr Glu Val Gly
 35 40 45
 40 ttt ctg gcg gcg gcc gtc agc gat ctg acg cgc gcg gac gcc att ttc 192
 Phe Leu Ala Ala Ala Val Ser Asp Leu Thr Arg Ala Asp Ala Ile Phe
 50 55 60
 45 aat gca ttg caa cgt gta cgg ccg ggc cgg acg cat ccc tgc atc ggc 240
 Asn Ala Leu Gln Arg Val Arg Pro Gly Arg Thr His Pro Cys Ile Gly
 65 70 75 80
 ctg gcg gtc gcc cgc atg aac gcc ggg ctg ccc gac gaa gcc gcc gag 288
 Leu Ala Val Ala Arg Met Asn Ala Gly Leu Pro Asp Glu Ala Ala Glu
 85 90 95
 50 atc ctg gcg aat ttc cag ccg gca cag ccg gag gac cgc tcg gaa ctg 336
 Ile Leu Ala Asn Phe Gln Pro Ala Gln Pro Glu Asp Arg Ser Glu Leu
 100 105 110
 55 gac gcc tgg tgc ggg ttc gct ctg ttg ctg gct ggc cgc tcg gac gag 384
 Asp Ala Trp Cys Gly Phe Ala Leu Leu Leu Ala Gly Arg Ser Asp Glu
 115 120 125
 60 gcg cgc cgc atg ctg cag cga gcc atc gat gcg ggt ggc gag gcg gca 432
 Ala Arg Arg Met Leu Gln Arg Ala Ile Asp Ala Gly Gly Glu Ala Ala

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130 135 140

5 agg ctg gcg cag gtc gtg ttg gac agc gga ccc gcc atg atg cgg ccc 480
 Arg Leu Ala Gln Val Val Leu Asp Ser Gly Pro Ala Met Met Arg Pro
 145 150 155 160

gcg ccg ttg cag tcc gag cca tta cct gga gct cct gga tga 522
 Ala Pro Leu Gln Ser Glu Pro Leu Pro Gly Ala Pro Gly *

10 165 170

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 <211> 173
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 <213> Bordetella pertussis

20 <400> 62
 Met His Ser Asp Ser Gly Ser Asp Ser Gly Ser Asp Ser Gly Ser Gly
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 Ser Pro Met Val Ser Ser Ile His Pro Ser Glu Pro Ile Gln Pro Met
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 Glu His Val Leu Glu Glu Ala Asp Ala Arg Leu Leu Thr Glu Val Gly
 35 40 45
 Phe Leu Ala Ala Ala Val Ser Asp Leu Thr Arg Ala Asp Ala Ile Phe
 50 55 60
 Asn Ala Leu Gln Arg Val Arg Pro Gly Arg Thr His Pro Cys Ile Gly
 65 70 75 80
 Leu Ala Val Ala Arg Met Asn Ala Gly Leu Pro Asp Glu Ala Ala Glu
 85 90 95
 30 Ile Leu Ala Asn Phe Gln Pro Ala Gln Pro Glu Asp Arg Ser Glu Leu
 100 105 110
 Asp Ala Trp Cys Gly Phe Ala Leu Leu Leu Ala Gly Arg Ser Asp Glu
 115 120 125
 35 Ala Arg Arg Met Leu Gln Arg Ala Ile Asp Ala Gly Gly Glu Ala Ala
 130 135 140
 Arg Leu Ala Gln Val Val Leu Asp Ser Gly Pro Ala Met Met Arg Pro
 145 150 155 160
 Ala Pro Leu Gln Ser Glu Pro Leu Pro Gly Ala Pro Gly
 165 170

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 <213> Bordetella pertussis

45 <220>
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 Met Val Ala Arg Gly Pro Cys Ala Pro Pro Gly Val Val Pro Ile Arg
 1 5 10 15

55 cgc gtc gta agt ttt acg gaa gac gtt cag cgc gtt gta tct gaa tgc 96
 Arg Val Val Ser Phe Thr Glu Asp Val Gln Arg Val Val Ser Glu Cys
 20 25 30

60 tcc ggt agc gac cgc gat ccg aca tta gtt tcg gaa gtt aac aac tgc 144
 Ser Gly Ser Asp Arg Asp Pro Thr Leu Val Ser Glu Val Asn Asn Cys

	35	40	45	
	cgg ata aaa ccg gca gtc agt atc ttg gtg acg tga			180
5	Arg Ile Lys Pro Ala Val Ser Ile Leu Val Thr *			
	50	55		
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	<211> 59			
10	<212> PRT			
	<213> Bordetella pertussis			
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	1 5 10 15			
	Arg Val Val Ser Phe Thr Glu Asp Val Gln Arg Val Val Ser Glu Cys			
	20 25 30			
	Ser Gly Ser Asp Arg Asp Pro Thr Leu Val Ser Glu Val Asn Asn Cys			
	35 40 45			
20	Arg Ile Lys Pro Ala Val Ser Ile Leu Val Thr			
	50 55			
	<210> 65			
	<211> 975			
25	<212> DNA			
	<213> Bordetella pertussis			
	<220>			
	<221> CDS			
30	<222> (1)...(975)			
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	1 5 10 15			
	ggg gac cgc cca ccc ccc gca cag gcg cgc gtc cag acg gta ctc ctg			96
	Gly Asp Arg Pro Pro Pro Ala Gln Ala Arg Val Gln Thr Val Leu Leu			
	20 25 30			
40	cac gga ctc tcc gcg ttg acg gcg caa gtt gcg cag cgc ttc gaa atg			144
	His Gly Leu Ser Ala Leu Thr Ala Gln Val Ala Gln Arg Phe Glu Met			
	35 40 45			
45	gcg cgc cac cgg atg gct ggc ccc ggt cgc acg aca ggc cac cac cat			192
	Ala Arg His Arg Met ala Gly Pro Gly Arg Thr Thr Gly His His His			
	50 55 60			
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	Phe Gln Leu Glu Ala Gln Arg Met ala Asp Thr Leu Arg Ser Val Gln			
	65 70 75 80			
	ggc gag cct cgg tgg ccg gac ggg agc gag gcc tgc atg ccg tcg ggt			288
	Gly Glu Pro Arg Trp Pro Asp Gly Ser Glu Ala Cys Met Pro Ser Gly			
	85 90 95			
55	ttg tca tgc cgg cat gga acc gaa gag ccg aaa gcg tca cac agt gca			336
	Leu Ser Cys Arg His Gly Thr Glu Glu Pro Lys Ala Ser His Ser Ala			
	100 105 110			
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	Tyr Ser Met Phe Pro Leu Arg Arg Thr Arg Tyr Thr Gln Gly Phe Glu	
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5	aca acg gcc cac cgc atg aac ttc cag atc cca ccc gct tta cct gct	432
	Thr Thr Ser Ala His Arg Met Asn Phe Gln Ile Pro Pro Ala Leu Pro Ala	
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10	ttg gag ctt gat gtc ttt gcg cgc gcc gcc agc caa gga gag acc cta	480
	Leu Glu Leu Asp Val Phe Ala Arg Ala Ala Ser Gln Gly Glu Thr Leu	
	145 150 155 160	
15	tat gtc acc aaa gca ggc gag cag ttc cag gtc atc gca tcc ggc acg	528
	Tyr Val Thr Lys Ala Gly Glu Gln Phe Gln Val Ile Ala Ser Gly Thr	
	165 170 175	
20	acg ccg tca ggg cgc aac gta tcc tgg gtc gcc acc gac gag gac acg	576
	Thr Pro Ser Gly Arg Asn Val Ser Trp Val Ala Thr Asp Glu Asp Thr	
	180 185 190	
25	ctt gtc atg ttt tcc agc gcg ctg gcg ctg gcc tac ggc acg gga atc	624
	Leu Val Met Phe Ser Ser Ala Leu Ala Leu Ala Tyr Gly Thr Gly Ile	
	195 200 205	
30	gcc cgc gcc gtc gcc aag gag ctc gat ctg cac gcg gtc ccg acg aca	672
	Ala Arg Ala Val Ala Lys Glu Leu Asp Leu His Ala Val Pro Thr Thr	
	210 215 220	
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	Ser Leu Ser Ala Arg Val Val Thr Arg Ala Val Asp Met ala Glu Thr	
	225 230 235 240	
40	tca cgc cac gcc ctg cag ggc gtg gat ttc ctt acc ttc ctg tcc tgg	768
	Ser Arg His Ala Leu Gln Gly Val Asp Phe Leu Thr Phe Leu Ser Trp	
	245 250 255	
45	tcg gcc cgc gcc gac gcc gcc ggc ttc cga cag gtc tgt cac gac acc	816
	Ser Ala Arg Ala Asp Ala Ala Gly Phe Arg Gln Val Cys His Asp Thr	
	260 265 270	
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	Gly Val Ser Pro Asp Gln Ile Ser Gly Thr Leu Arg Ala Thr Ile Asp	
	275 280 285	
55	gaa agc atg cag cag cgc ttc gca tcc gcc gca caa tca ggt aag gcg	912
	Glu Ser Met Gln Gln Arg Phe Ala Ser Ala Ala Gln Ser Gly Lys Ala	
	290 295 300	
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<213> Bordetella pertussis

<400> 66

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 35 40 45
 10 Ala Arg His Arg Met ala Gly Pro Gly Arg Thr Thr Gly His His His
 50 55 60
 Phe Gln Leu Glu Ala Gln Arg Met ala Asp Thr Leu Arg Ser Val Gln
 65 70 75 80
 15 Gly Glu Pro Arg Trp Pro Asp Gly Ser Glu Ala Cys Met Pro Ser Gly
 85 90 95
 Leu Ser Cys Arg His Gly Thr Glu Glu Pro Lys Ala Ser His Ser Ala
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 Tyr Ser Met Phe Pro Leu Arg Arg Thr Arg Tyr Thr Gln Gly Phe Glu
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 30 Ala Arg Ala Val Ala Lys Glu Leu Asp Leu His Ala Val Pro Thr Thr
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 260 265 270
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 275 280 285
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	Trp Tyr Arg Arg Val Arg Val Pro Arg Pro Ile Tyr Glu Glu Leu Val	
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	Gly Gln Arg Gly Trp Leu His Arg Ile Gly Ile Asp Ala Lys Ala Gln	
	35 40 45	
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	Asn Ser Pro Cys Thr Ser Val Pro Val Ala Ile Ala Ala Arg Cys Leu	
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	Asn Val Val Leu Ala Leu Ala Pro Ala Gln Ile Ala Met Phe Ala Asn	
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	Ser Pro Leu Glu Ala Gly Arg Val Thr Gly Leu Lys Glu Asn Arg Leu	
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	Thr Leu Trp Pro Arg Met Phe Arg Gly Ala Arg Tyr Leu Gly Asp Asp	
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	Phe Arg Trp Met Phe Gly Gly Leu Thr Ala Ser Arg Ala Leu Pro Pro	
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	Gly Asp Ala Cys Asp Tyr Lys Asn Ala Asp Val Ala Cys Leu Val Gly	
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40	gcc cct tcg ctg gca gag ttc ctg tat gcg ggc gcg tgg tcc gcg cga	528
	Ala Pro Ser Leu Ala Glu Phe Leu Tyr Ala Gly Ala Trp Ser Ala Arg	
	165 170 175	
	aac ctg aat gat ggc ggt tcc gtg cgt ctg gcc gcg cgc agc gaa cat	576
	Asn Leu Asn Asp Gly Gly Ser Val Arg Leu Ala Ala Arg Ser Glu His	
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	Phe Val Tyr Ser Gln Phe Ala Gln Phe Leu Asp Ala Arg Trp Arg Tyr	
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50	agg atg ccg att gtc ccc gcc ttg ccg gcg ctg ttg cga gcc tgg gac	672
	Arg Met Pro Ile Val Pro Ala Leu Pro Ala Leu Leu Arg Ala Trp Asp	
	210 215 220	
55	agg cag ggc ggc ctg gaa gcg ctg ttc gag cag gcc ggc gcg caa ggc	720
	Arg Gln Gly Gly Leu Glu Ala Leu Phe Glu Gln Ala Gly Ala Gln Gly	
	225 230 235 240	
60	tac atc gag ggg cgc gcg ccg ggc gcg gta ttt gcc gat gcc gac ttg	768
	Tyr Ile Glu Gly Arg Ala Pro Gly Ala Val Phe Ala Asp Ala Asp Leu	
	245 250 255	

	ctg agc tca gcc ggc gat gca gtc gcg gcc agt gcg ccg atg gcg gcg	816
	Leu Ser Ser Ala Gly Asp Ala Val Ala Ala Ser Ala Pro Met ala Ala	
	260 265 270	
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	Ser Ala Leu Gln Leu Gly Leu Leu Arg Asn Leu His Asp Ala Glu Ala	
	275 280 285	
10	ctg gtg agg cga tgg ggc tgg ctg cgc ttg cgt gcg ttg cgc gat cgg	912
	Leu Val Arg Arg Trp Gly Trp Leu Arg Leu Arg Ala Leu Arg Asp Arg	
	290 295 300	
15	gcc atc gct ttg gcg ttg gac gat gcg cag gtg cgc tgc ctt tgc caa	960
	Ala Ile Ala Leu Ala Leu Asp Asp Ala Gln Val Arg Cys Leu Cys Gln	
	305 310 315 320	
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	Gln Val Val Ala Val Ala Glu Gly Gly Leu Ala Gly Asp Glu Gln Gln	
	325 330 335	
25	tgg ctc gat tat gtg cgt tac gtg gtg gaa acc ggc gag acc gcc gcg	1056
	Trp Leu Asp Tyr Val Arg Tyr Val Val Glu Thr Gly Glu Thr Ala Ala	
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	Asp Arg Met Leu Arg Leu Trp Arg Gln Ala Arg Gly Thr Pro Glu Met	
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	35 40 45	
	Asn Ser Pro Cys Thr Ser Val Pro Val Ala Ile Ala Arg Cys Leu	
	50 55 60	
	Asn Val Val Leu Ala Leu Ala Pro Ala Gln Ile Ala Met Phe Ala Asn	
	65 70 75 80	
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	Thr Leu Trp Pro Arg Met Phe Arg Gly Ala Arg Tyr Leu Gly Asp Asp	
	100 105 110	
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	Phe Arg Trp Met Phe Gly Gly Leu Thr Ala Ser Arg Ala Leu Pro Pro	
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	Gly Asp Ala Cys Asp Tyr Lys Asn Ala Asp Val Ala Cys Leu Val Gly	
	145 150 155 160	
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	Asn	Leu	Asn	Asp	Gly	Gly	Ser	Val	Arg	Leu	Ala	Ala	Arg	Ser	Glu	His	
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		210					215					220					
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	Tyr	Ile	Glu	Gly	Arg	Ala	Pro	Gly	Ala	Val	Phe	Ala	Asp	Ala	Asp	Leu	
				245					250					255			
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			260						265					270			
15	Ser	Ala	Leu	Gln	Leu	Gly	Leu	Leu	Arg	Asn	Leu	His	Asp	Ala	Glu	Ala	
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	Leu	Val	Arg	Arg	Trp	Gly	Trp	Leu	Arg	Leu	Arg	Ala	Leu	Arg	Asp	Arg	
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	Gln	Val	Val	Ala	Val	Ala	Glu	Gly	Gly	Leu	Ala	Gly	Asp	Glu	Gln	Gln	
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	Trp	Leu	Asp	Tyr	Val	Arg	Tyr	Val	Val	Glu	Thr	Gly	Glu	Thr	Ala	Ala	
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25	Asp	Arg	Met	Leu	Arg	Leu	Trp	Arg	Gln	Ala	Arg	Gly	Thr	Pro	Glu	Met	
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	1				5					10					15		
45	ctc	gcg	tgg	ccc	atc	gcg	gcg	gca	tcc	agc	cct	cct	cct	gtc	gcg	gcc	96
	Leu	Ala	Trp	Pro	Ile	Ala	Ala	Ala	Ser	Ser	Pro	Pro	Pro	Val	Ala	Ala	
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50	ctg	agc	tcc	ggc	gtc	gcc	ctt	acc	tgc	ccc	cgc	ctt	ccg	cct	ccc	tcc	144
	Leu	Ser	Ser	Gly	Val	Ala	Leu	Thr	Ser	Pro	Arg	Leu	Pro	Pro	Pro	Ser	
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55	cat	aca	tcc	ggc	cgg	aaa	tgg	cgc	atc	ggc	tat	gtg	ggc	agc	ggc	gag	192
	His	Thr	Ser	Gly	Arg	Lys	Trp	Arg	Ile	Gly	Tyr	Val	Gly	Ser	Gly	Glu	
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	Tyr	Glu	Glu	Tyr	Pro	Arg	Thr	Leu	Tyr	Ala	Ile	Ala	Arg	Ala	Leu	Gln	
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	caa	ctc	gga	tgg	ctg	cgt	atc	gac	gac	atg	ccc	gag	ata	acc	gat	atg	288
	Gln	Leu	Gly	Trp	Leu	Arg	Ile	Asp	Asp	Met	Pro	Glu	Ile	Thr	Asp	Met	

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15	ttg cgg cct gcc gtg cgc gaa gcc gtt gcg gca cgc ctg cat ggc gcc Leu Arg Pro Ala Val Arg Glu Ala Val Ala Ala Leu His Gly Ala 130 135 140	432		
20	aag gac atc gac ctg atc atc gcc atg ggt acc tgg gct gga cag gac Lys Asp Ile Asp Leu Ile Ile Ala Met Gly Thr Trp Ala Gly Gln Asp 145 150 155 160	480		
25	atg gtc gaa ctg ggc acg ccg gta ccc acc gtg gtc gtc tcg tcg acc Met Val Glu Leu Gly Thr Pro Val Pro Thr Val Val Val Ser Ser Thr 165 170 175	528		
30	gac ccg ata agc gcc cgg atc ata ccc agt gcg gcc gac agc ggc cag Asp Pro Ile Ser Ala Arg Ile Ile Pro Ser Ala Ala Asp Ser Gly Gln 180 185 190	576		
35	gac aac ctg cat gcc cgg gta cag ccc gac cac tac cag cgg cag atc Asp Asn Leu His Ala Arg Val Gln Pro Asp His Tyr Gln Arg Gln Ile 195 200 205	624		
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45	gaa gac acc gaa gca ggt cgc acc tac gca gcc atc gat aag gtc gcc Glu Asp Thr Glu Ala Gly Arg Thr Tyr Ala Ala Ile Asp Lys Val Ala 225 230 235 240	720		
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60	tac cag aag ctg tcg agc gaa gtc gac gcc ttt tac gtc acc gag cac Tyr Gln Lys Leu Ser Ser Glu Val Asp Ala Phe Tyr Val Thr Glu His 275 280 285	864		
65	cgg ggc atc acc tcg acg tcc gtc aag cag ctc gcc gcg ctg ctg cgc Arg Gly Ile Thr Ser Thr Ser Val Lys Gln Leu Ala Ala Leu Leu Arg 290 295 300	912		
70	gcc gcc cgc gtg ccg agt ttc tcg atg caa ggc tcc gac gag gtc aag Ala Ala Arg Val Pro Ser Phe Ser Met Gln Gly Ser Asp Glu Val Lys 305 310 315 320	960		
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	325	330	335	
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	cgc agc atc agc cag gtc tgg aat gcc ccc gcc aag ata gcc atc aat Arg Ser Ile Ser Gln Val Trp Asn Ala Pro Ala Lys Ile Ala Ile Asn 355 360 365			1104
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15	ctg gcg gcc gac gag gtg tac gaa gcg gag cac tga cag gcc tgg cca Leu Ala Ala Asp Glu Val Tyr Glu Ala Glu His * Gln Ala Trp Pro 385 390 395			1200
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	Leu Arg Pro Ala Val Arg Glu Ala Val Ala Ala Arg Leu His Gly Ala 130 135 140 Lys Asp Ile Asp Leu Ile Ile Ala Met Gly Thr Trp Ala Gly Gln Asp 145 150 155 160			
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	Ala	Tyr	Arg	Val	Gly	Arg	Arg	Asp	Asp	His	Gly	Gly	Tyr	Arg	Arg	Ala	
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	Gln	Phe	Asp	His	Val	Leu	Ser	Ser	Pro	Gly	Thr	His	Gly	Asp	Asp	Gln	
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	Gly	Arg	Pro	Gln	Gly	Gly	Val	Glu	Val	Ala	Gly	Leu	Pro	Pro	Arg	Ile	
55					85					90					95		
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	Gly	His	Glu	Leu	Asp	Val	Val	Ala	Ala	Gly	Met	Arg	Gly	Gln	Val	Lys	
				100					105					110			
60																	

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	cca ggc ctt tcg cat atc ggt tat ctc ggg cat gtc gtc gat acg cag	384
	Pro Gly Leu Ser His Ile Gly Tyr Leu Gly His Val Val Asp Thr Gln	
	115 120 125	
5	cca tcc gag ttg ttg caa tgc gcg cgc gat cgc gta gag cgt gcg cgg	432
	Pro Ser Glu Leu Leu Gln Cys Ala Arg Asp Arg Val Glu Arg Ala Arg	
	130 135 140	
10	ata ctc ctc gta ctc gcc gct acc cac ata acc gat gcg cca ttt ccg	480
	Ile Leu Leu Val Leu Ala Ala Thr His Ile Thr Asp Ala Pro Phe Pro	
	145 150 155 160	
15	gcc gga tgt atg gga ggg agg cgg aag gcg ggg cga ggt aag ggc gac	528
	Ala Gly Cys Met Gly Gly Arg Arg Lys Ala Gly Arg Gly Lys Gly Asp	
	165 170 175	
20	gcc gga gct cag gcc cgc gac agg agg agg gct gga tgc cgc cgc gat	576
	Ala Gly Ala Gln Gly Arg Asp Arg Arg Ala Gly Cys Arg Arg Asp	
	180 185 190	
	ggg cca cgc gag gcc aag aag cag gcc gag cgg gcc gag tat tcc ggg	624
	Gly Pro Arg Glu Ala Lys Lys Gln Gly Glu Arg Gly Glu Tyr Ser Gly	
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25	gcg aag ggt cat ggg cga tga	645
	Ala Lys Gly His Gly Arg *	
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	<213> Bordetella pertussis	
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40	Ala Tyr Arg Val Gly Arg Arg Asp Asp His Gly Gly Tyr Arg Arg Ala	
	35 40 45	
	Gln Phe Asp His Val Leu Ser Ser Pro Gly Thr His Gly Asp Asp Gln	
	50 55 60	
45	Val Asp Val Leu Gly Ala Met Gln Ala Cys Arg Asn Gly Phe Ala His	
	65 70 75 80	
	Gly Arg Pro Gln Gly Gly Val Glu Val Ala Gly Leu Pro Pro Arg Ile	
	85 90 95	
	Gly His Glu Leu Asp Val Val Ala Ala Gly Met Arg Gly Gln Val Lys	
	100 105 110	
50	Pro Gly Leu Ser His Ile Gly Tyr Leu Gly His Val Val Asp Thr Gln	
	115 120 125	
	Pro Ser Glu Leu Leu Gln Cys Ala Arg Asp Arg Val Glu Arg Ala Arg	
	130 135 140	
55	Ile Leu Leu Val Leu Ala Ala Thr His Ile Thr Asp Ala Pro Phe Pro	
	145 150 155 160	
	Ala Gly Cys Met Gly Gly Arg Arg Lys Ala Gly Arg Gly Lys Gly Asp	
	165 170 175	
	Ala Gly Ala Gln Gly Arg Asp Arg Arg Ala Gly Cys Arg Arg Asp	
	180 185 190	
60	Gly Pro Arg Glu Ala Lys Lys Gln Gly Glu Arg Gly Glu Tyr Ser Gly	

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195 200 205

Ala Lys Gly His Gly Arg
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<212> DNA
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Met Ser Asn Thr Tyr Phe Pro Arg Trp Arg Leu Ala Asp Asp Thr Val
1 5 10 15

20 ccg ggc gcg gtc atc gcg ccc gac gaa cgc ctg tcc tgg ccc aag aac 96
Pro Gly Ala Val Ile Ala Pro Asp Glu Arg Leu Ser Trp Pro Lys Asn
20 25 30

25 atc gcc atg ggg gcc cag cac gtg gtc gcc atg ttc ggt tcc acc gtg 144
Ile Ala Met Gly Ala Gln His Val Val Ala Met Phe Gly Ser Thr Val
35 40 45

30 ctg gcg ccg ctg ctg atg ggt ttc gac ccc aat gtg gcg atc ctc atg 192
Leu Ala Pro Leu Leu Met Gly Phe Asp Pro Asn Val Ala Ile Leu Met
50 55 60

35 tcc ggc atc ggc acg ctg atc ttc ttc ctg ttc gtc ggc ggc cgg gtg 240
Ser Gly Ile Gly Thr Leu Ile Phe Phe Leu Phe Val Gly Gly Arg Val
65 70 75 80

40 ccc agc tac ctg ggc tcc agc ttc gcc ttc atc ggc ggc gtg gtg gcg 288
Pro Ser Tyr Leu Gly Ser Ser Phe Ala Phe Ile Gly Gly Val Val Ala
85 90 95

45 gtc acc ggc tat gtg gcg ccc ggc gcc aac gcc aat atc ggc gtg gcg 336
Val Thr Gly Tyr Val Ala Pro Gly Ala Asn Ala Asn Ile Gly Val Ala
100 105 110

50 ctc ggc gcg atc atc gcc tgt ggc ctg gtg tac gcg ctg atc ggc ctg 384
Leu Gly Ala Ile Ile Ala Cys Gly Leu Val Tyr Ala Leu Ile Gly Leu
115 120 125

55 gtc gta tgg gcg gcc agc gcg cgc gcc aac ggc ggc cgc tgg atc gag 432
Val Val Trp Ala Ala Ser Ala Arg Gly Asn Gly Ala Arg Trp Ile Glu
130 135 140

60 gcc atg atg ccg ccg gtc gtc acg ggc gcg gtg gtg gcg gtg atc ggc 480
Ala Met Met Pro Pro Val Val Thr Gly Ala Val Val Ala Val Ile Gly
145 150 155 160

55 ctg aac ctg gcc ccg atc gcc gcc aag ggc gcc atg ggt tcg tcc ggc 528
Leu Asn Leu Ala Pro Ile Ala Ala Lys Gly Ala Met Gly Ser Ser Gly
165 170 175

60 ttc gag gcc agc atg gcg ttg atg acc atc ctg tgc gtg ggc ggc atc 576
Phe Glu Ala Ser Met ala Leu Met Thr Ile Leu Cys Val Gly Gly Ile

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	180	185	190	
5	gcc gtc tac acg cgc ggc atg gtg cag cgg ctg ctg atc ctg gtc ggc Ala Val Tyr Thr Arg Gly Met Val Gln Arg Leu Leu Ile Leu Val Gly 195 200 205	624		
10	ctg gtg ctg gcc tgc gtc atc tac gcg gtc tgc gcc aac ggc ctg ggg Leu Val Leu Ala Cys Val Ile Tyr Ala Val Cys Ala Asn Gly Leu Gly 210 215 220	672		
15	ctg ggc gcg ccc atg gac ttc gcc aag gtg gcc gcc gcg ccg tgg ttc Leu Gly Ala Pro Met Asp Phe Ala Lys Val Ala Ala Ala Pro Trp Phe 225 230 235 240	720		
20	ggc ctg ccc agc ttc gcc gcg ccg gtg ttc gag ccg cag gcc atg ggc Gly Leu Pro Ser Phe Ala Ala Pro Val Phe Glu Pro Gln Ala Met Gly 245 250 255	768		
25	ctg atc gtg ccg gtg gcc atc atc ctg gtg gcc gag aac ctg ggc cac Leu Ile Val Pro Val Ala Ile Ile Leu Val Ala Glu Asn Leu Gly His 260 265 270	816		
30	gtg aag gcg gtc gcc gcc atg acc gga cag gac ctg gac cgc tac gtg Val Lys Ala Val Ala Ala Met Thr Gly Gln Asp Leu Asp Arg Tyr Val 275 280 285	864		
35	ggc cgc gcc ttc gtg gcc gac gcc gtg gcg acc atg gtt tcc ggc gcc Gly Arg Ala Phe Val Gly Asp Gly Val Ala Thr Met Val Ser Gly Ala 290 295 300	912		
40	gtc ggc ggc acc ggg gtg acc acc tac gcc gag aat atc ggc gtg atg Val Gly Gly Thr Gly Val Thr Thr Tyr Ala Glu Asn Ile Gly Val Met 305 310 315 320	960		
45	gcc gtg acg cgc atc tat tcc acg ctg gtg ttc gtg gtg gcg gcc gtg Ala Val Thr Arg Ile Tyr Ser Thr Leu Val Phe Val Val Ala Val 325 330 335	1008		
50	atc gcg ctg gtg ctg ggg ttc tcg ccc aag ttc ggc gcg ctg atc cag Ile Ala Leu Val Leu Gly Phe Ser Pro Lys Phe Gly Ala Leu Ile Gln 340 345 350	1056		
55	acc atc ccc ggc ccc gtg ctg ggg gcc atg tcg gtc gtg gtg ttc ggc Thr Ile Pro Gly Pro Val Leu Gly Gly Met Ser Val Val Val Phe Gly 355 360 365	1104		
60	ctg atc gcc atc gcc ggc gcg cgc atc tgg gtg gtc aac cag gtc gat Leu Ile Ala Ile Ala Gly Ala Arg Ile Trp Val Val Asn Gln Val Asp 370 375 380	1152		
65	ttc agc gac aac cgc aat ctg atc gtg gcc gcc gtg acc ctg gtg ctg Phe Ser Asp Asn Arg Asn Leu Ile Val Ala Ala Val Thr Leu Val Leu 385 390 395 400	1200		
70	ggg gcg ggc gac ttc agc gtc aag ctg ggc gat ttc tcg atg aac ggc Gly Ala Gly Asp Phe Ser Val Lys Leu Gly Asp Phe Ser Met Asn Gly 405 410 415	1248		
75	atc ggc acc gcc acg ttc ggc gcc atc atc ctg tac gcc ctg ctg ggc Ile Gly Thr Ala Thr Phe Gly Ala Ile Ile Leu Tyr Ala Leu Leu Gly 420 425 430 435 440	1296		

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420 425 430

ctg gcg cgt cgc cgc tga
 Leu Ala Arg Arg Arg *

5 435

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 <213> Bordetella pertussis

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 Pro Gly Ala Val Ile Ala Pro Asp Glu Arg Leu Ser Trp Pro Lys Asn
 20 25 30
 Ile Ala Met Gly Ala Gln His Val Ala Met Phe Gly Ser Thr Val
 35 40 45
 20 Leu Ala Pro Leu Leu Met Gly Phe Asp Pro Asn Val Ala Ile Leu Met
 50 55 60
 Ser Gly Ile Gly Thr Leu Ile Phe Phe Leu Phe Val Gly Gly Arg Val
 65 70 75 80
 25 Pro Ser Tyr Leu Gly Ser Ser Phe Ala Phe Ile Gly Gly Val Val Ala
 85 90 95
 Val Thr Gly Tyr Val Ala Pro Gly Ala Asn Ala Asn Ile Gly Val Ala
 100 105 110
 Leu Gly Ala Ile Ile Ala Cys Gly Leu Val Tyr Ala Leu Ile Gly Leu
 115 120 125
 30 Val Val Trp Ala Ala Ser Ala Arg Gly Asn Gly Ala Arg Trp Ile Glu
 130 135 140
 Ala Met Met Pro Pro Val Val Thr Gly Ala Val Val Ala Val Ile Gly
 145 150 155 160
 35 Leu Asn Leu Ala Pro Ile Ala Ala Lys Gly Ala Met Gly Ser Ser Gly
 165 170 175
 Phe Glu Ala Ser Met ala Leu Met Thr Ile Leu Cys Val Gly Gly Ile
 180 185 190
 Ala Val Tyr Thr Arg Gly Met Val Gln Arg Leu Leu Ile Leu Val Gly
 195 200 205
 40 Leu Val Leu Ala Cys Val Ile Tyr Ala Val Cys Ala Asn Gly Leu Gly
 210 215 220
 Leu Gly Ala Pro Met Asp Phe Ala Lys Val Ala Ala Pro Trp Phe
 225 230 235 240
 45 Gly Leu Pro Ser Phe Ala Ala Pro Val Phe Glu Pro Gln Ala Met Gly
 245 250 255
 Leu Ile Val Pro Val Ala Ile Ile Leu Val Ala Glu Asn Leu Gly His
 260 265 270
 Val Lys Ala Val Ala Ala Met Thr Gly Gln Asp Leu Asp Arg Tyr Val
 275 280 285
 50 Gly Arg Ala Phe Val Gly Asp Gly Val Ala Thr Met Val Ser Gly Ala
 290 295 300
 Val Gly Gly Thr Gly Val Thr Thr Tyr Ala Glu Asn Ile Gly Val Met
 305 310 315 320
 55 Ala Val Thr Arg Ile Tyr Ser Thr Leu Val Phe Val Val Ala Ala Val
 325 330 335
 Ile Ala Leu Val Leu Gly Phe Ser Pro Lys Phe Gly Ala Leu Ile Gln
 340 345 350
 Thr Ile Pro Gly Pro Val Leu Gly Gly Met Ser Val Val Val Phe Gly
 355 360 365
 60 Leu Ile Ala Ile Ala Gly Ala Arg Ile Trp Val Val Asn Gln Val Asp

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370
 Phe Ser Asp Asn Arg Asn Leu Ile Val Ala Ala Val Thr Leu Val Leu
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 Gly Ala Gly Asp Phe Ser Val Lys Leu Gly Asp Phe Ser Met Asn Gly
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 Ile Gly Thr Ala Thr Phe Gly Ala Ile Ile Leu Tyr Ala Leu Leu Gly
 420
 Leu Ala Arg Arg Arg
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 Cys Phe Leu Ala Val Leu Met Leu Ser Gly Ala Leu Thr Trp Arg Asn
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 gcg ggc agg agc gcc gcc gag atc gag ggg ctg aac cag gtc gcc gtc
 Ala Gly Arg Ser Ala Ala Glu Ile Glu Gly Leu Asn Gln Val Ala Val
 35 40 45
 aac cag gtc gac ccg ctg ttc gag gcc agc ggc gcg gcg cag cgc cag
 Asn Gln Val Asp Pro Leu Phe Glu Ala Ser Gly Ala Ala Gln Arg Gln
 50 55 60
 gcg gcc acg caa ttc cag cgc tac gtg gac gtg ccc aag gag ccg gcc
 Ala Ala Thr Gln Phe Gln Arg Tyr Val Asp Val Pro Lys Glu Pro Ala
 65 70 75 80
 gcg gcc gag ctg gcc gcg acc ctg cag acg cgc tgg cgc gcc tac cag
 Ala Ala Glu Leu Ala Ala Thr Leu Gln Thr Arg Trp Arg Ala Tyr Gln
 85 90 95
 tcg gtg ctg gac gag ctg gcc gcc gcc gtc gac gcc ggc cag gcc gag
 Ser Val Leu Asp Glu Leu Ala Ala Ala Val Asp Ala Gly Gln Ala Glu
 100 105 110
 ccc gcc ctg gcc gcc atg cat cgc gcg cag cag gcc gaa cat gca ttc
 Pro Ala Leu Ala Ala Met His Arg Ala Gln Gln Ala Glu His Ala Phe
 115 120 125
 cag cgc gac atg gaa gcc ttt ctg gcc agg gta cag gcg cac agc gac
 Gln Arg Asp Met Glu Ala Phe Leu Ala Arg Val Gln Ala His Ser Asp
 130 135 140
 gaa gtg cgc agc ggc gcc gag gac acc cat gtc gtg gcc cgc tgg agc
 Glu Val Arg Ser Gly Ala Glu Asp Thr His Val Val Ala Arg Trp Ser
 145 150 155 160

48
 96
 144
 192
 240
 288
 336
 384
 432
 480

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	gcc atc gcg ctg acc acg ctg ggc gtg ctg ctg acc ctg gcc ggc tgg	528
	Ala Ile Ala Leu Thr Thr Leu Gly Val Leu Leu Thr Leu Ala Gly Trp	
	165 170 175	
5	ctg ttc gtg cgc cgc gcg gtg ctg cgc ccc ttg ctg gag gcc ggc cat	576
	Leu Phe Val Arg Arg Ala Val Leu Arg Pro Leu Leu Glu Ala Gly His	
	180 185 190	
10	cat ttc gac cgc atc gcc gac ggc gac ctc acc gcg cgc atc gag gtg	624
	His Phe Asp Arg Ile Ala Asp Gly Asp Leu Thr Ala Arg Ile Glu Val	
	195 200 205	
15	cgc tcg gcc aat gaa atc ggc gcg ctg ttc gcg gcg ctc aag cgc atg	672
	Arg Ser Ala Asn Glu Ile Gly Ala Leu Phe Ala Ala Leu Lys Arg Met	
	210 215 220	
20	cag gaa ggc ctg acg cgc acc atc gcc gtc atg cgg cgc ggc gtc gac	720
	Gln Glu Gly Leu Thr Arg Thr Ile Ala Val Met Arg Arg Gly Val Asp	
	225 230 235 240	
	gaa atc aac gtc ggc gcg gcc gag atc tcg gcc ggc aac gcc aac ctg	768
	Glu Ile Asn Val Gly Ala Ala Glu Ile Ser Ala Gly Asn Ala Asn Leu	
	245 250 255	
25	tcc agc cgc acg gag gag cag gcc gcc gcc ctg gaa gag acc gcg gcc	816
	Ser Ser Arg Thr Glu Glu Gln Ala Ala Ala Leu Glu Glu Thr Ala Ala	
	260 265 270	
30	acc atg gag gaa ctg gcc acc acg gtc aag cag aac gcc gac aat gcc	864
	Thr Met Glu Glu Leu Ala Thr Thr Val Lys Gln Asn Ala Asp Asn Ala	
	275 280 285	
35	gcg cag gcc aat cag ctg gcc gcc gtc agc atg cag gtg gcg cag cgc	912
	Ala Gln Ala Asn Gln Leu Ala Val Ser Met Gln Val Ala Gln Arg	
	290 295 300	
40	ggc ggc gag tcg gtc gcg cag gtg gtg cag acc atg cac ggc atc tcc	960
	Gly Gly Glu Ser Val Ala Gln Val Val Gln Thr Met His Gly Ile Ser	
	305 310 315 320	
	gcg agc tcg cgc cag atc gcc gac atc gtc acc gtg atc gac ggc atc	1008
	Ala Ser Ser Arg Gln Ile Ala Asp Ile Val Thr Val Ile Asp Gly Ile	
	325 330 335	
45	gcc ttc cag acc aat atc ctg gcg ctg aac gcc gcg gtc gag gcg gcg	1056
	Ala Phe Gln Thr Asn Ile Leu Ala Leu Asn Ala Ala Val Glu Ala Ala	
	340 345 350	
50	cgc gcc ggc gaa cag ggc aag ggc ttc gcg gtg gtg gcg ggc gag gtg	1104
	Arg Ala Gly Glu Gln Gly Lys Gly Phe Ala Val Val Ala Gly Glu Val	
	355 360 365	
55	cgc agc ctg gcc cag cgc gcc gcg cag gcg gcc aag gag atc aag gcc	1152
	Arg Ser Leu Ala Gln Arg Ala Ala Gln Ala Ala Lys Glu Ile Lys Ala	
	370 375 380	
60	ctg atc gag agc tcg gtg gcg acg gtg cgc gcc ggc tcg caa cag gtc	1200
	Leu Ile Glu Ser Ser Val Ala Thr Val Arg Ala Gly Ser Gln Gln Val	
	385 390 395 400	

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	gcc agc gcc ggc ggc acc atg gac gag gtg gtg gcc tcg gta cag cgc Ala Ser Ala Gly Gly Thr Met Asp Glu Val Val Ala Ser Val Gln Arg 405 410 415	1248
5	gtg gcc gac atc atg ggg gag atc tcg gcc gcc tcg gcc cag cag gcc Val Ala Asp Ile Met Gly Glu Ile Ser Ala Ala Ser Ala Gln Gln Ala 420 425 430	1296
10	agc ggc atc gac cag gtc agc ctg gcg att tcg caa atg gac gaa acc Ser Gly Ile Asp Gln Val Ser Leu Ala Ile Ser Gln Met Asp Glu Thr 435 440 445	1344
15	acc cag cag aat gcc gcg ctg gtc gaa cag gcc gcg gcg gcg gcc acg Thr Gln Gln Asn Ala Ala Leu Val Glu Gln Ala Ala Ala Ala Thr 450 455 460	1392
20	gcc atg gaa gaa cag gcc cgc cac ctg gcg gcc gcg gcg gcg gtc ttc Ala Met Glu Glu Gln Ala Arg His Leu Ala Ala Ala Ala Val Phe 465 470 475 480	1440
	agg acg cag ggc ggc gcc atc atc gac gtc gcc gcc gcg ccg ctg gcc Arg Thr Gln Gly Gly Ala Ile Ile Asp Val Ala Ala Ala Pro Leu Ala 485 490 495	1488
25	ggg ccg gcg ggc ggc cat gcc gcc ctg ccg ccg gcc gcg gcc cac tga Gly Pro Ala Gly Gly His Ala Ala Leu Pro Pro Ala Ala Ala His * 500 505 510	1536
30	<210> 76 <211> 511 <212> PRT <213> Bordetella pertussis	
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	Cys Phe Leu Ala Val Leu Met Leu Ser Gly Ala Leu Thr Trp Arg Asn 20 25 30	
40	Ala Gly Arg Ser Ala Ala Glu Ile Glu Gly Leu Asn Gln Val Ala Val 35 40 45	
	Asn Gln Val Asp Pro Leu Phe Glu Ala Ser Gly Ala Ala Gln Arg Gln 50 55 60	
45	Ala Ala Thr Gln Phe Gln Arg Tyr Val Asp Val Pro Lys Glu Pro Ala 65 70 75 80	
	Ala Ala Glu Leu Ala Ala Thr Leu Gln Thr Arg Trp Arg Ala Tyr Gln 85 90 95	
	Ser Val Leu Asp Glu Leu Ala Ala Ala Val Asp Ala Gly Gln Ala Glu 100 105 110	
50	Pro Ala Leu Ala Ala Met His Arg Ala Gln Gln Ala Glu His Ala Phe 115 120 125	
	Gln Arg Asp Met Glu Ala Phe Leu Ala Arg Val Gln Ala His Ser Asp 130 135 140	
55	Glu Val Arg Ser Gly Ala Glu Asp Thr His Val Val Ala Arg Trp Ser 145 150 155 160	
	Ala Ile Ala Leu Thr Thr Leu Gly Val Leu Leu Thr Leu Ala Gly Trp 165 170 175	
	Leu Phe Val Arg Arg Ala Val Leu Arg Pro Leu Leu Glu Ala Gly His 180 185 190	
60	His Phe Asp Arg Ile Ala Asp Gly Asp Leu Thr Ala Arg Ile Glu Val	

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	35	40	45	
5	gac gcc gcc cgc gaa cgc cag ggc ttc atc gaa ggc cgg atc tcc gaa Asp Ala Ala Arg Glu Arg Gln Gly Phe Ile Glu Gly Arg Ile Ser Glu 50 55 60	192		
10	ctc gag ggc acg ctt tcg aac gcg cac ctc atc gat cca acg gcg ctc Leu Glu Gly Thr Leu Ser Asn Ala His Leu Ile Asp Pro Thr Ala Leu 65 70 75 80	240		
15	gac gcc gaa ggc cgt gcc gtg ttc ggc gcg acc gtg gaa atc gaa gac Asp Ala Glu Gly Arg Ala Val Phe Gly Ala Thr Val Glu Ile Glu Asp 85 90 95	288		
20	ctc gac tcg ggc gac cgc ctg acc tac cag atc gtg ggc gac gtc gaa Leu Asp Ser Gly Asp Arg Leu Thr Tyr Gln Ile Val Gly Asp Val Glu 100 105 110	336		
25	gcc gac atc aag tcc aac ctg att tcg gtc tcc agc ccg gtg gcc cgc Ala Asp Ile Lys Ser Asn Leu Ile Ser Val Ser Ser Pro Val Ala Arg 115 120 125	384		
30	gcc ctg atc ggc aaa tcc gag ggc gat gtg gtc gaa gtg aag gtg ccg Ala Leu Ile Gly Lys Ser Glu Gly Asp Val Val Glu Val Lys Val Pro 130 135 140	432		
35	gct ggc gtg cgc gag tac gaa gtc atc ggt gtg cgt tat ctc tga Ala Gly Val Arg Glu Tyr Glu Val Ile Gly Val Arg Tyr Leu * 145 150 155	477		
	<210> 78 <211> 158 <212> PRT <213> Bordetella pertussis			
40	<400> 78 Met Ser Ala Ile Pro Leu Thr Val Arg Gly Ala Glu Arg Leu Gln Gln 1 5 10 15 Glu Leu His Arg Leu Lys Thr Val Glu Arg Pro Ala Val Ile Ser Ala 20 25 30 Ile Ala Glu Ala Arg Ala Gln Gly Asp Leu Ser Glu Asn Ala Glu Tyr 35 40 45 Asp Ala Ala Arg Glu Arg Gln Gly Phe Ile Glu Gly Arg Ile Ser Glu 50 55 60 Leu Glu Gly Thr Leu Ser Asn Ala His Leu Ile Asp Pro Thr Ala Leu 65 70 75 80 Asp Ala Glu Gly Arg Ala Val Phe Gly Ala Thr Val Glu Ile Glu Asp 85 90 95 Leu Asp Ser Gly Asp Arg Leu Thr Tyr Gln Ile Val Gly Asp Val Glu 100 105 110 Ala Asp Ile Lys Ser Asn Leu Ile Ser Val Ser Ser Pro Val Ala Arg 115 120 125 Ala Leu Ile Gly Lys Ser Glu Gly Asp Val Val Glu Val Lys Val Pro 130 135 140 Ala Gly Val Arg Glu Tyr Glu Val Ile Gly Val Arg Tyr Leu 145 150 155			
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 <220>
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 <222> (1)...(951)
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15	atg gtc cag caa ttg atc gcc cat caa gtt tgt gtg cct gaa gcg gcc	96
	Met Val Gln Gln Leu Ile Ala His Gln Val Cys Val Pro Glu Ala Ala	
	20 25 30	
20	cgc gcc tat ggg gtc acc gcg ccg act gtg cgc aaa tgg ctg ggc cgc	144
	Arg Ala Tyr Gly Val Thr Ala Pro Thr Val Arg Lys Trp Leu Gly Arg	
	35 40 45	
25	ttc ctg gct cag ggc cag gcg ggc ttg gcc gat gcg tcc tcg cgc ccg	192
	Phe Leu Ala Gln Gly Gln Ala Gly Leu Ala Asp Ala Ser Ser Arg Pro	
	50 55 60	
30	acg gtc tcg ccc cga gcg att gcg ccg gcc aag gcg ctg gct atc gtg	240
	Thr Val Ser Pro Arg Ala Ile Ala Pro Ala Lys Ala Leu Ala Ile Val	
	65 70 75 80	
35	gag ctg cgc cgc aag cgg ctg acc caa gcg cgc atc gcc cag gcg ctg	288
	Glu Leu Arg Arg Lys Arg Leu Thr Gln Ala Arg Ile Ala Gln Ala Leu	
	85 90 95	
40	ggc gtg tca gcc agc acc gtc agc cgc gtc ctg gcc cgc gcc ggt ctg	336
	Gly Val Ser Ala Ser Thr Val Ser Arg Val Leu Ala Arg Ala Gly Leu	
	100 105 110	
45	tcg cac ctg gcc gac ctg gag ccg gcc gag ccg gtg gtg cgc tac gag	384
	Ser His Leu Ala Asp Leu Glu Pro Ala Glu Pro Val Val Arg Tyr Glu	
	115 120 125	
50	cat cag gcc ccc ggc gat ctg ctg cac atc gac atc aag aag ctg gga	432
	His Gln Ala Pro Gly Asp Leu Leu His Ile Asp Ile Lys Lys Leu Gly	
	130 135 140	
55	cgt atc cag cgc cct ggc cac cgg gtc acg ggc aac cga cgc gat acc	480
	Arg Ile Gln Arg Pro Gly His Arg Val Thr Gly Asn Arg Arg Asp Thr	
	145 150 155 160	
60	gtt gag ggg gcc ggc tgg gac ttc gtc ttc gtg gcc atc gat gac cac	528
	Val Glu Gly Ala Gly Trp Asp Phe Val Phe Val Ala Ile Asp Asp His	
	165 170 175	
65	gcc cgc gtg gcc ttc acc gac atc cac ccc gac gag cgc ttc ccc agc	576
	Ala Arg Val Ala Phe Thr Asp Ile His Pro Asp Glu Arg Phe Pro Ser	
	180 185 190	
70	gcc gtc cag ttc ctc aag gac gca gtg gcc tac tac cag cgc ctg ggc	624
	Ala Val Gln Phe Leu Lys Asp Ala Val Ala Tyr Tyr Gln Arg Leu Gly	
	195 200 205	

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	gtg acc atc cag cgc ttg ctc acc gac aat ggc tcg gcc ttt cgc agc	672
	Val Thr Ile Gln Arg Leu Leu Thr Asp Asn Gly Ser Ala Phe Arg Ser	
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5	cgc gcc ttc gcc gcg ctg tgc cat gag ctg ggc atc aag cac cgc ttt	720
	Arg Ala Phe Ala Ala Leu Cys His Glu Leu Gly Ile Lys His Arg Phe	
	225 230 235 240	
10	acc cga cct tac cgc cca cag acc aat ggc aag gcc gaa cgc ttc atc	768
	Thr Arg Pro Tyr Arg Pro Gln Thr Asn Gly Lys Ala Glu Arg Phe Ile	
	245 250 255	
15	cag tcg gcc ttg cgt gag tgg gct tac gct cac acc tac cag aac tcc	816
	Gln Ser Ala Leu Arg Glu Trp Ala Tyr Ala His Thr Tyr Gln Asn Ser	
	260 265 270	
20	caa cac cga gcc gat gcc atg aaa tcc tgg cta cac cac tac aac tgg	864
	Gln His Arg Ala Asp Ala Met Lys Ser Trp Leu His His Tyr Asn Trp	
	275 280 285	
	cat cga ccc cac caa ggc atc ggg cgc gct gta ccc atc tcc aga ctc	912
	His Arg Pro His Gln Gly Ile Gly Arg Ala Val Pro Ile Ser Arg Leu	
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	35 40 45	
	Phe Leu Ala Gln Gly Gln Ala Gly Leu Ala Asp Ala Ser Ser Arg Pro	
	50 55 60	
45	Thr Val Ser Pro Arg Ala Ile Ala Pro Ala Lys Ala Leu Ala Ile Val	
	65 70 75 80	
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	Gly Val Ser Ala Ser Thr Val Ser Arg Val Leu Ala Arg Ala Gly Leu	
	100 105 110	
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	His Gln Ala Pro Gly Asp Leu Leu His Ile Asp Ile Lys Lys Leu Gly	
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	145 150 155 160	
	Val Glu Gly Ala Gly Trp Asp Phe Val Phe Val Ala Ile Asp Asp His	
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	Ala Arg Val Ala Phe Thr Asp Ile His Pro Asp Glu Arg Phe Pro Ser	
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10	Gln Ser Ala Leu Arg Glu Trp Ala Tyr Ala His Thr Tyr Gln Asn Ser 260 265 270	Gln His Arg Ala Asp Ala Met Lys Ser Trp Leu His His Tyr Asn Trp 275 280 285	His Arg Pro His Gln Gly Ile Gly Arg Ala Val Pro Ile Ser Arg Leu 290 295 300	
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40	ctc agc gcg gtc gtg aca tcg gtg ctg aac gcc tat gcc gcg cag gcc Leu Ser Ala Val Val Thr Ser Val Leu Asn Ala Tyr Ala Ala Gln Ala 35 40 45			144
45	gag cgc gga cac gtc act acc ggc gcc gcc aag ggc atg gcg cgt gtc Glu Arg Gly His Val Thr Thr Gly Ala Ala Lys Gly Met ala Arg Val 50 55 60			192
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15	gat ttc tac gac tac ttc gtg ctg gca gac ggg cgt ctg tgc ttt gcc Asp Phe Tyr Asp Tyr Phe Val Leu Ala Asp Gly Arg Leu Cys Phe Ala 420 425 430			1296
20	atc ggc gac gta tcc gga aaa ggc gtg ccc gcg gcc ctg ttc atg gcc Ile Gly Asp Val Ser Gly Lys Gly Val Pro Ala Ala Leu Phe Met ala 435 440 445			1344
25	atc gtc agg acc ttg ata cgc agc gtg gcg gaa gaa gag cac gac ccg Ile Val Arg Thr Leu Ile Arg Ser Val Ala Glu Glu His Asp Pro 450 455 460			1392
30	ggc gcc atc gcc acc aag gtg aac cac cgt ctg gcc gag aac aac ccc Gly Ala Ile Ala Thr Lys Val Asn His Arg Leu Ala Glu Asn Asn Pro 465 470 475 480			1440
35	aag ctg atg ttt gtc acc ttg ctg ata ggc gtc ttc acc ccg gaa aca Lys Leu Met Phe Val Thr Leu Leu Ile Gly Val Phe Thr Pro Glu Thr 485 490 495			1488
40	ggc gcc ctg gcc tgg gtc aac gcc ggc cac ccg ccg ccg ctg ctc atc Gly Ala Leu Ala Trp Val Asn Ala Gly His Pro Pro Pro Leu Leu Ile 500 505 510			1536
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610

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 35 40 45
 Glu Arg Gly His Val Thr Thr Gly Ala Ala Lys Gly Met ala Arg Val
 50 55 60
 Trp Leu Asn His Leu Asp Leu Gly Pro Arg Arg Val Ala Phe Ala Tyr
 65 70 75 80
 20 Asp Ala Glu Gly Thr Val Leu Ala Ser Thr Asn Pro Arg Met Ile Asp
 85 90 95
 Arg Asp Leu Ser Gly Ile Arg Asp Phe Lys Gly Arg Pro Leu Ala Ala
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 115 120 125
 Pro Ser Pro Leu Asp Glu Ser Ala Gln Met Arg His Ala Tyr Phe Val
 130 135 140
 Tyr Phe Pro Ala Trp Lys Trp Val Leu Ala Ile Ser Asp Ser Ser Gln
 145 150 155 160
 30 Ala Ile Ile Asp Lys Val Ala Ala Gln Lys Ala Asn Met Ile Ala Ala
 165 170 175
 Ile Asp Arg Asn Leu Ser Glu Leu Arg Leu Ser Arg His Gly Phe Val
 180 185 190
 35 Phe Val Val Ala Asp Asp Gly Thr Val Ile Val Pro Pro Pro Pro Ser
 195 200 205
 Ala Ala Arg Leu Leu Asp Ser Thr Asp Val Glu Ser Gly Arg Val Leu
 210 215 220
 His Ser Met Leu Ala Glu Ile Ser Ser Thr Arg Gly Leu Thr Leu Arg
 225 230 235 240
 40 Phe Thr Asn Gly Glu Ser Ala Trp Gln Ile Asp Ala Leu Arg Tyr Lys
 245 250 255
 Pro Leu His Trp Thr Ile Ile Gly Val Val Pro Glu Pro Asp Leu Thr
 260 265 270
 45 Asp Pro Ala Gln Asn Leu Val Arg Arg Gln Ala Leu Ile Phe Ala Ala
 275 280 285
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 305 310 315 320
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 Pro Arg Arg Arg Asp Glu Val Gly Gln Leu Ala Glu Ser Phe Leu
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 55 Phe Met Asn Glu Gln Leu His His Asn Val Arg Ala Leu Met ala Gln
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 Ile Ser Asn Arg Glu Arg Leu Glu Ser Glu Leu Ser Ile Ala Arg Ser
 370 375 380
 Ile Gln Leu Gly Leu Leu Pro Gln Pro Leu Pro Asp Ala Ala Thr Arg
 385 390 395 400
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	Ile	Val	Arg	Thr	Leu	Ile	Arg	Ser	Val	Ala	Glu	Glu	Glu	His	Asp	Pro
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	465					470					475					480
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	Thr	Ile	Ile	Ala	Ile	His	Arg	Pro								
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